the OIL AND GAS JOURNAL

AUGUST 8, 1955

In California's low-gravity fields
Down-Hole Heating Pays Off 66

Chemicals Cut Pipeline R.O.W. Upkeep . . . 88

Better Estimates of Energy Needs 91

How First Ultraformer Has Performed . . . 119

Rising capacity means refiners will have

Coke to burn

P. 62

COMPLETE TABLE OF CONTENTS ON PAGES 2 - 3

Wyatt's... Floating Roof

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PAGE 1 ONE . . . *a glance ahead*

Justice Department officially didn't want the job of looking into state proration and allowables practices, as required by amendment to Compact Commission approval, but certain career staff members have long itched to investigate charges of price control and discrimination. This may provide sounding board for complaints of producers aggrieved at all sorts of conservation regulations.

Taxes on motor fuel and trucks will get searching review by Congress prior to reviving highway-construction bill next session. Problems include state-federal division, whether gasoline tax should be at refiner or distributor level, exemptions for nonhighway uses. Oil industry might accept new taxes without fuss if equitably levied and all channeled into highway building.

Pressure to curb imports will continue strong. Now that Congress is away, producers will keep heat on ODM for action under new tariff law. Outlook is that imports will be just high enough to rile producers, not quite high enough to give ODM a clear-cut cause for action. So: prolonged investigation and political rhubarb.

Natural-gas regulation will be in a twilight zone for next 6 months. FPC, which favors the Harris bill now halfway through Congress, will enforce the present law but without enthusiasm. Producers, who last winter were determined to seek judicial restraints on FPC authority, may find courts reluctant to act because of the legislative situation.

Next session of Congress will be rough on oil and gas industry. With elections coming up, Democrats will try to build issue that the administration is too friendly to "big business." Investigations, threats of more regulation, attacks on present practices will be order of the day.

Polyethylene is becoming the most competitive big-volume petrochemical. New uses for this versatile plastic and race to install improved and lower-cost producing processes forecast price reductions and perhaps a price war.

the OIL AND GAS JOURNAL

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IN THE NEWS

New Construction Means Over-Supply of Coke ... 62
Bottom-Hole Heating Stepped Up in California ... 66
New Chemically Powered Cutoff, Perforating Tool Unveiled ... 67
Beaver County Wildcat Rated Valuable Producer ... 67
Highly Planned Automatic Flood Planned for Centralia Field ... 68
Gas-Oil Ratio Doubled for Ailing Spraberry Field ... 69
Phillips Rigs Up 40 Miles Off Louisiana ... 69
World's Northernmost Well Is Air Force Gasser ... 70
Esso Puts Industry's Second Fluid Coker on Stream ... 71
Canadians Try to Extract Oil from Athabasca Tar Sands ... 72
Third Firm Fights for Pipeline from Sundre-Westward Ho ... 73
Industry's First Nuclear Reactor for Research Announced ... 74
Water Flooding Superior to Gas Injection in SACROC ... 74
Texas Tidelands' Deepest Test Drills Ahead ... 75
U. S. Tanker Tonnage Drops Again ... 75
27 Senators Ask Flemming to Order Cut in Imports ... 76
New Study Ordered for Wyoming's Clareton Field ... 77
Can One Pipeline Bid Up Field Prices in Another's Area? ... 78
Some South American Nations Easing Price Controls ... 79
Dozen Companies Apply for Acreage in Libya ... 79
McCarthy's Cut from Bolivian Sale Halved ... 80
Pemex Dedicates New Refinery Units, Crude Line ... 81

EXPLORATION FEATURES

Among the Drilling Contractors ... 131
Salt Domes—A Geological Enigma ... 155
Correlating Geological and Geophysical Data ... 156
Exploration Highlights ... 157

DEPARTMENTS

They Say ... 52
Calendar of Events ... 54
Journally Speaking ... 57
Editorial ... 59
This Week ... 61
International News ... 79
Pipeline Patrol—Construction ... 134
Equipment Digest ... 143
Trade Literature ... 148
Equipment Men in News ... 151
Personals ... 172
Deaths in the Industry ... 173
Statistical Summary ... 174
Drilling Statistics ... 175
Supply Statistics ... 176
Refining Statistics ... 177
Demand Statistics ... 178
Monthly Statistics ... 179
Classified Advertising ... 180
Advertisers' Index ... 185

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TECHNOLOGY—OPERATION

What Water Flooding Did for Delhi Field 82

By P. W. Meek and Paul B. Fletcher

This has proved to be a highly successful operation. After 15 months of water injection, average reservoir pressure increased 17 psi. and field pressure differential was cut 132 psi. Expansion of original and secondary gas caps has stopped and average produced gas-oil ratio has been reduced 17 per cent.

Chemicals Cut Pipeline R.O.W. Upkeep 88

By Neil G. Wilson

Here are the results of a 4-year program by Shell Pipe Line on chemical control of weeds and brush on pipeline right-of-ways. The program has been entirely satisfactory and savings over hand-clearing are in the range of 75 per cent over all.

Better Estimates of Beam-Pumping Energy Needs 91

By W. J. Fairbanks

Shell Oil Co. has cut down the oversizing of electric motors on beam-pumped wells in its Ardmore, Okla., district. The result has been a saving of $40 to $200 per well in investment costs. The power bill has been cut by 7 per cent.

Oil-Base Mud Aids Bates Pool Discovery 95

By Donald M. Davis

Bates pool, Kern County, California, appears to have been discovered because the operator used oil-base drilling fluid. The discovery was completely surrounded by seven dry holes and one non-commercial producer. Six of these were within 1,000 ft. of the discovery well.

Why the Hydroformer Piping Failed 98

By F. Lawrence Resen

Humble's Baytown refinery metallurgical group has solved a number of special problems with materials in recycle gas service and carbon steel tubes in the waste heat boiler. Replacement tubes of 1¼ per cent Cr, ½ per cent Mo steel were selected for recycle gas service.

How to Straighten Crooked Holes 106

By John W. Speer and George H. Holliday

Stabilizers in the drilling string eliminate the deviation tendency caused by weight on bit and increase the force tending to bring the hole back to vertical. The effect of drill-collar size on deviation control when using stabilizers is discussed.

On-the-Job, In the Plants: Where Manifold Welding Fittings Apply 115

By Edward F. Harrington

This new piping component is being used increasingly in high-pressure service conditions. It is used primarily where multiple small outlets are required on a single run, where such outlets must be closely spaced, and where they must be positioned at various points around the room.

How the First Ultraformer Has Performed 119

By R. R. Gumaer and L. L. Raiford

The world's first Ultraformer at Pan Am Southern's El Dorado, Ark., refinery has been in operation since May 1954. The unit upgrades a highly paraffinic naphtha and has operated at octane levels in excess of 95 research clear.

REGULAR FEATURES

Engineering Reference Section 125-129

Foreman's Page 125

Refiner's Notebook 127

Questions on Technology 129

Compact installation of three 7-cylinder Model 38F-90 drilling engines operating compound, giving 1575 continuous rated hp. for pumps and draw works.

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From block to flywheel the Fairbanks-Morse Model 38F has all the features you expect to find in a rugged, responsive engine for continuous service under the shock and strain of field service. Such as . . .

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All Fuel . . . natural gas, propane or diesel oil. On each fuel the Model 38F operates at high (diesel) compression, insuring highest fuel economy and cleanest operation. Ask your nearby Fairbanks-Morse Oil Field Engineer for complete data on the line of Model 38F engines available in six power sizes of 4, 5, 6, 7, 8 or 10 cylinders —continuous slush pump rating of 75 hp. per cylinder. Fairbanks, Morse & Co., Chicago 5, Illinois.

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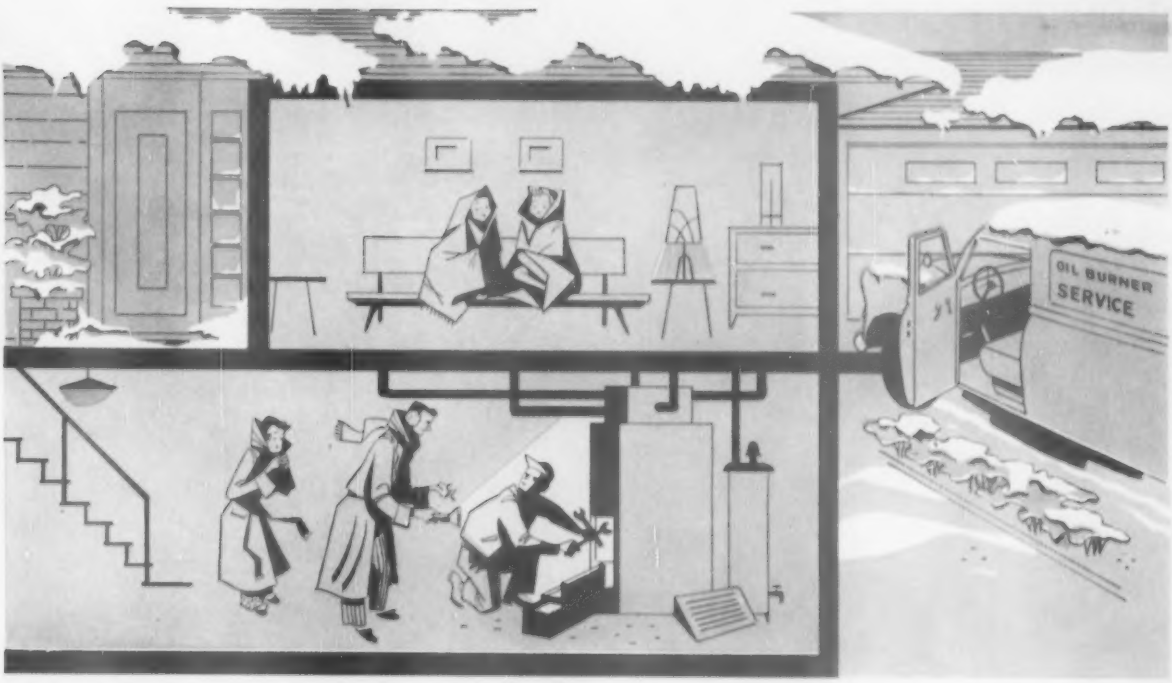

Oil burner ignition failures can be curbed with this ASHLESS heating oil additive

YOU CAN now use a *single additive* to do *two important jobs.*

As a stabilizer and dispersant, Du Pont Fuel Oil Additive No. 2 does a highly efficient job of preventing sludge formations that cause filter fouling and nozzle plugging.

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Being a nonmetallic *ashless* additive, it does not leave a metallic ash deposit which can foul the operation of the electrical system. Thus, it helps to eliminate many of the service calls that cost your distributors time and money . . . and even loss of business through customer dissatisfaction.

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Added to freshly prepared stocks at the refinery, FOA-2 retards the formation of insoluble residues during storage . . . keeps oil free flowing and clean burning. Too, it reduces the particle size of any residues that are formed . . . helps clean out sludge deposits that clog burner filters, screens and nozzles.

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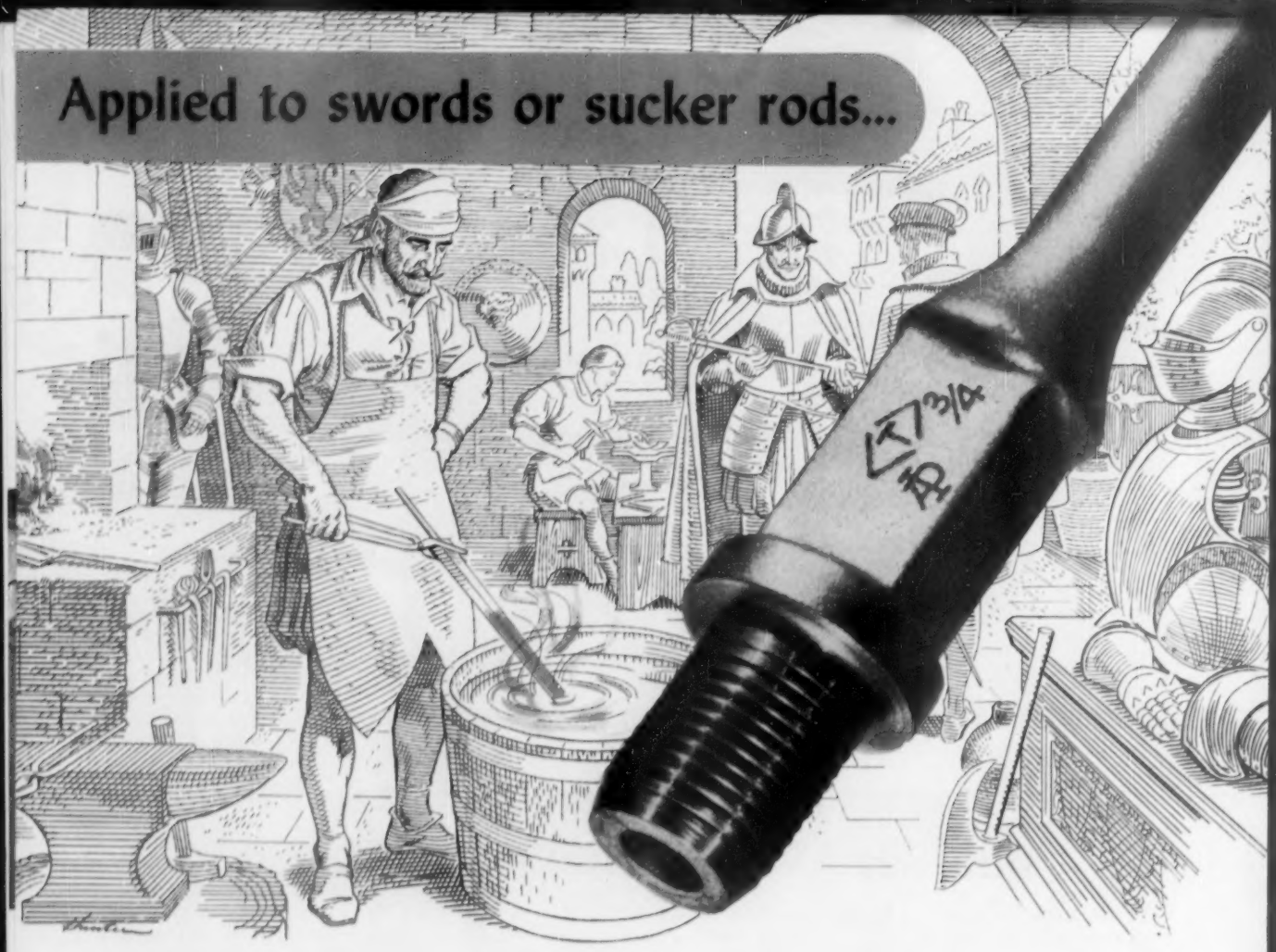

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TOLEDO STEEL was highly prized all over Europe because it was tough, strong and resilient. In combat, swords made of this steel proved their superiority because these Spanish craftsmen practiced the early art of liquid quenching.

Metallurgical science has since developed many additional steps that are meticulously controlled to improve liquid quenching . . . especially for alloy steels . . . and "Oilwell" uses them all in manufacturing the three alloy grades of sucker rods, designed to combat the varied problems of deep well pumping.

The advantages of these extra heat-treating steps are shown in the Sucker Rod Comparison Chart which we will be glad to furnish without cost upon request . . . but they will become measurable when you run your own field test and compare the service liquid-quenched versus air-cooled rods will give in your own particular well. No slower cooling method approaches liquid quenching in capturing the grain structure which imparts optimum properties to alloy steels.

Variations in the chemical composition and alloy content of rod steels affects the service application as well as the price of finished sucker rods; but "Oilwell" gives you this extra heat-treating step in Grade "T," "W," and "Y" sucker rods at no extra cost. Run a string in your next well and learn how much the added strength, toughness and fatigue resistance of liquid-quenched rods can save you in operating costs.

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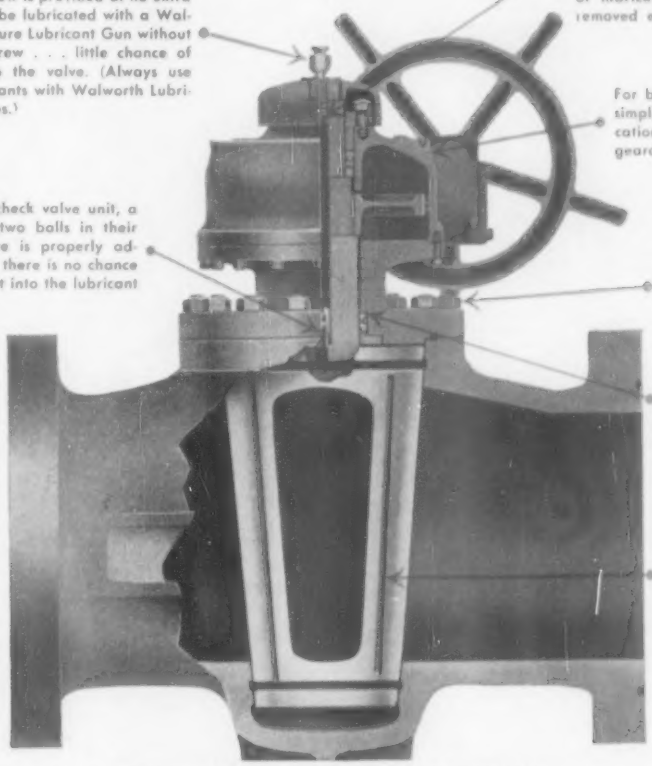
An added safety feature in the form of a groove cut part way up side of the lubricant-fitting screw allows the operator to observe any tendency of lubricant to blow out before the screw is removed entirely.

For buried pipelines — yoke design permits simple attachment of handwheel and lubrication extensions without modifying the gearcase.

In the stainless steel check valve unit, a transverse pin holds two balls in their seats. When the valve is properly adjusted and lubricated, there is no chance for line pressure to get into the lubricant system.

Standard bolt threads, rather than fine threads, mean easy replacement of nuts and bolts from local stocks.



Two overlapping Teflon packing rings form an effective seal against possible leakage without "grabbing" the plug shank. Low breakout torque . . . plug turns easier. Packing serves only as a seal and is not used to hold the plug in its seat.

Lubricant grooves completely frame the port openings and encircle the plug at the top and bottom assuring a tight seal against leaks. Bottom circumferential groove is separate from, but connected with, the lubricant well.

Other Walworth Lubricated Plug Valves include Single Gland and Regular Gland types. Sizes to 30 inches. Pressures to 5000 psi. and for vacuum service.

Cutaway of a 24-inch Walworth Lubricated Plug Valve

Without exception, a Walworth Ball Bearing Lubricated Plug Valve is easier to operate and maintain than any other type of rotary-action, sealed valve available today for pipeline service. Design features pointed out here show just a few advantages of Walworth Ball Bearing Lubricated Plug Valves.

Many pipeline companies throughout the world use Walworth valves for handling gas, crude, and finished products. Investigate the line of Walworth valves for your own needs. See your Walworth Distributor, or write for literature: Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.

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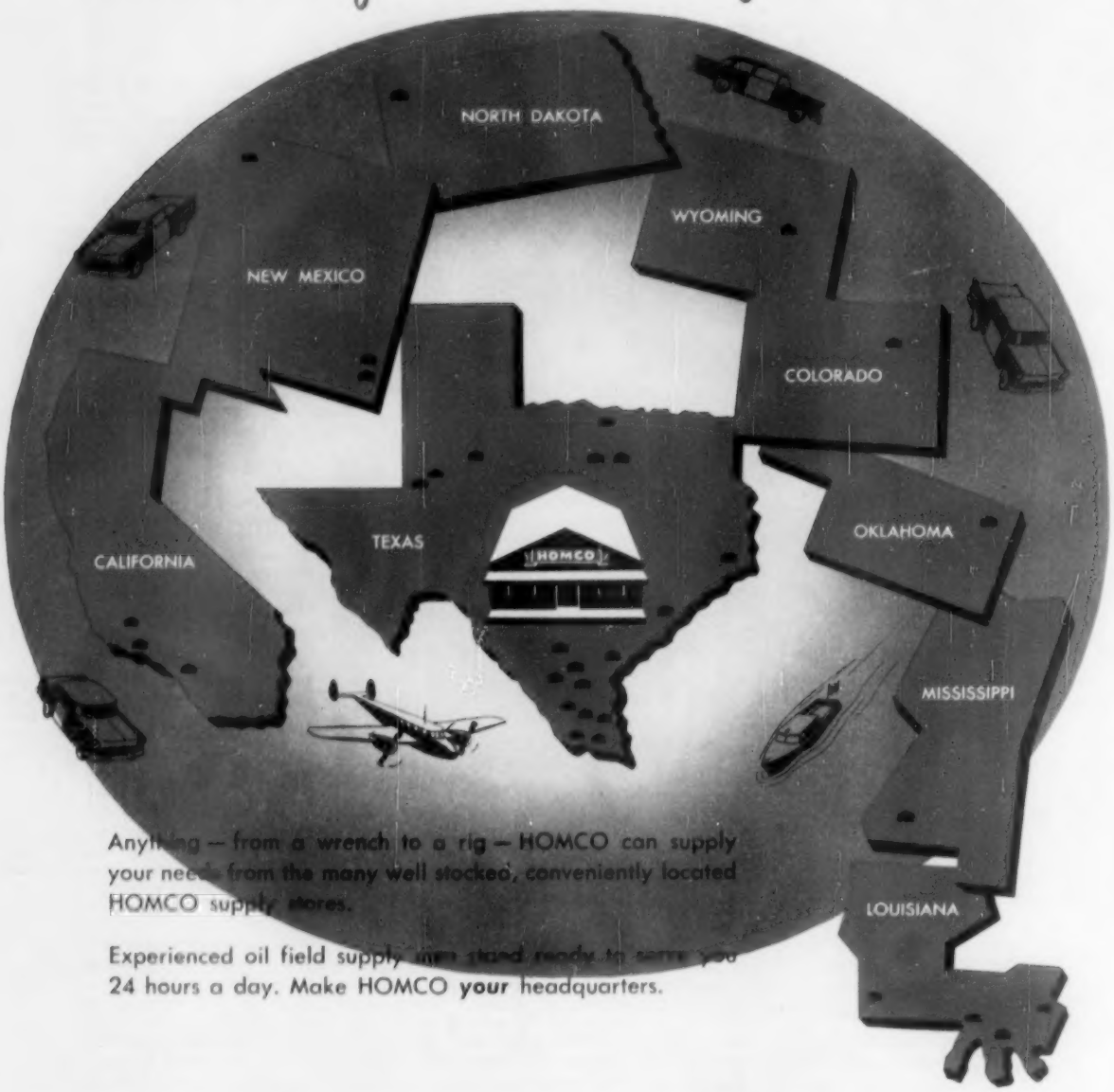

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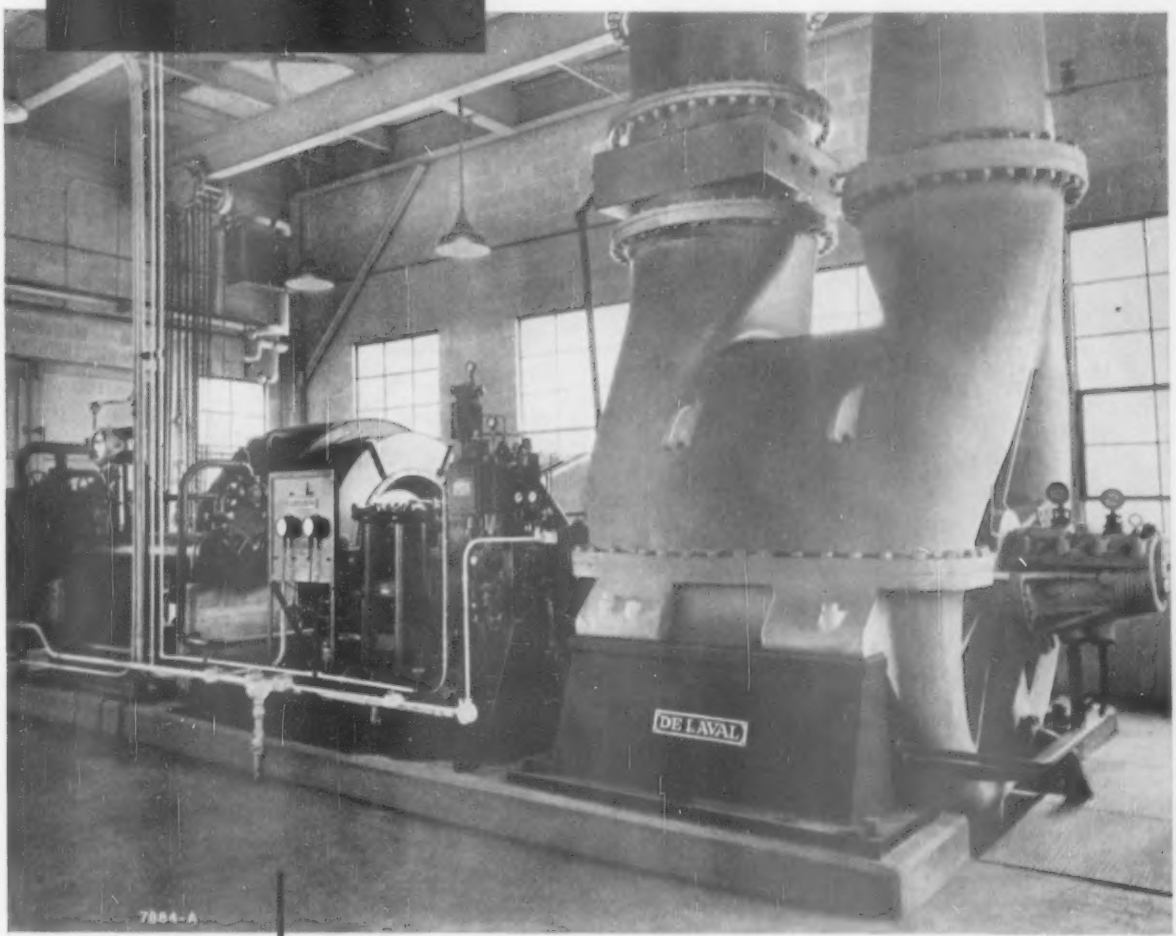

Send for new Bulletin 0504

This De Laval centrifugal blower does a dependable job in the new Model B Orthoflow cat cracker of the British American Oil Co., Ltd. at Clarkson, Ontario.

The unit delivers 48,400 cubic feet of air per minute for the regeneration of spent catalyst. Inlet pressure is 14.2 psia, and discharge pressure 35.4 psia. The De Laval blower operating at 3,700 rpm is driven through a speed increasing gear by a 4,500 hp electric motor.

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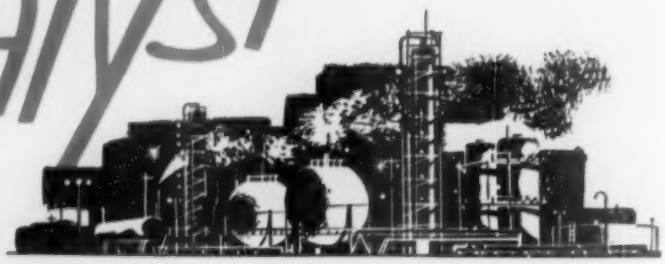

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0-20 Microns	9	4	2	2	2
0-30 Microns	16	11	6	5	4
0-40 Microns	28	21	12	10	8
. . . and a *minimum* of coarse particles					
Sieve analysis: Wt. %					
on 100 mesh (149 microns)	0	0	1	1	1
on 140 mesh (104 microns)	1	1	4	6	8
on 200 mesh (74 microns)	4	5	15	22	33

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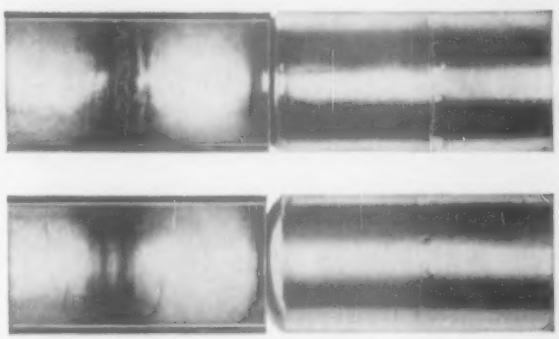
Smooth, sound joints—every time. HELIARC welding produces joints free from obstructions, notches, and crevices which hinder or trap flowing materials within the piping system. The penetration bead in the pipe is held within 1/32-in. of the pipe's normal inside diameter.

For the full story on argon-backed, stainless steel pipe fabrication, ask your local LINDE representative for the booklet, "Inert-Tungsten Arc Welding of Stainless Steel Piping," F-8463. In addition, he will be glad to give you complete information on how HELIARC welding cuts time and cost in many other applications. Start saving now—call him today.



Top—interior and exterior of completed welds without argon backing. Bottom—with argon backing, note the smooth, porosity-free, high quality welds.

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Beth-Co-Weld line pipe is sold on a competitive basis. It is manufactured to API 5-L Specifications in standard weights, and is also available in weights lighter than standard. It can be furnished coated, or uncoated for field wrapping. It can also be wrapped at the mill. Whether your job requires a large load, a single carload, or only a few lengths, you can depend upon prompt delivery.

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Packaged Compressor Plant

Lowest Cost Per Horsepower Installed

ROWAN AND HOPE installed a compressor station at its Sweetwater gasoline plant to convert to profit flare gas from nearby Nolan County Wells. Upon recommendation of the design engineer, the station was equipped with a 10SVG 550 h.p Beaird-Ingersoll-Rand packaged compressor plant. Picking up 2,500,000 cubic feet of gas daily from the wells at 5 psig, the unit operates with three stages of compression. As the gas leaves each stage, it is cycled through the plant for processing. Finally with both gasoline and LP-Gas removed, the residue is delivered to the sales line at 525 psig.

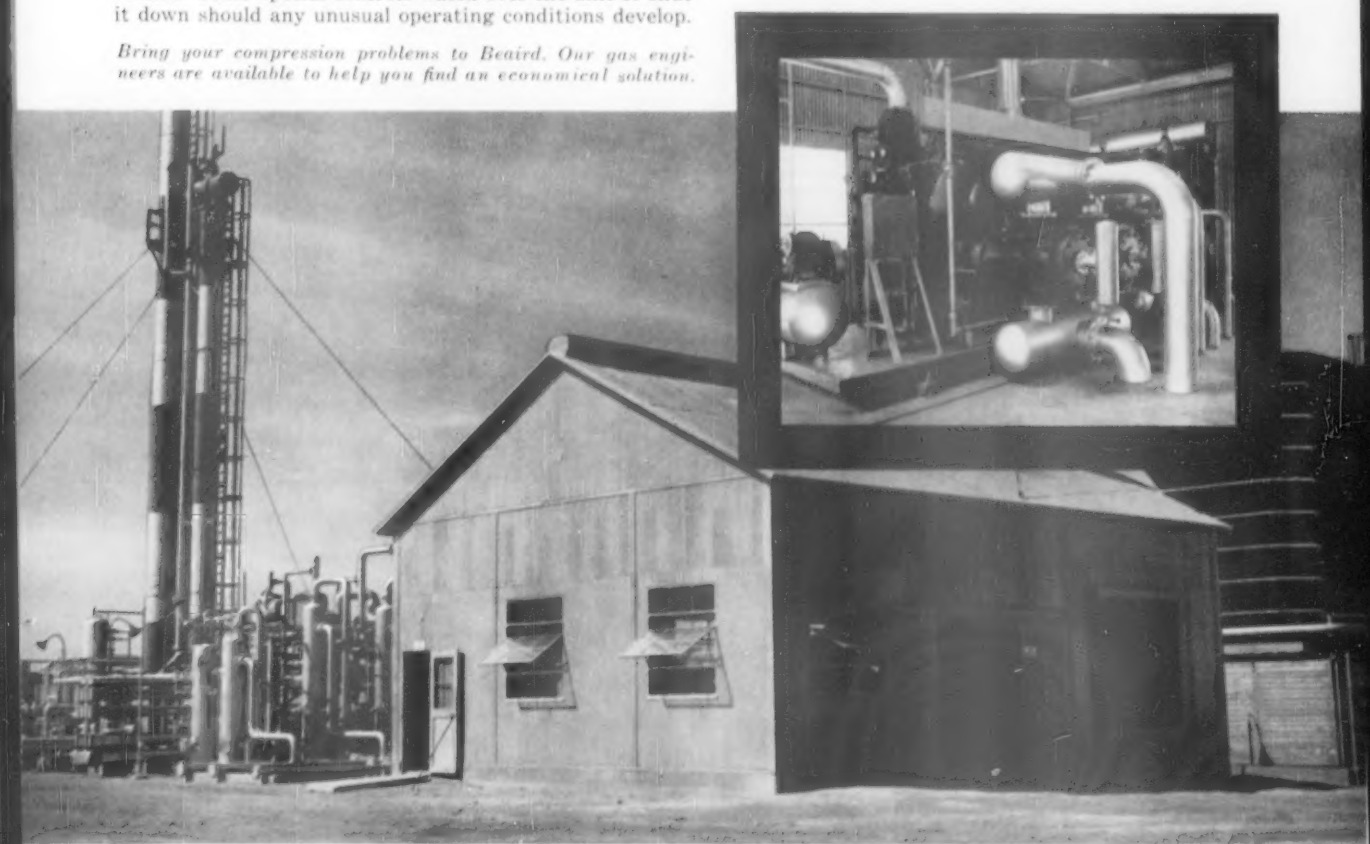
Rowan and Hope have found the unit to be exceptionally economical. Definite savings in both time and cost of installation were realized by the shipment of the compressor plant, fully assembled, directly to the Sweetwater location. And in 15 months of continuous service it has been down only a few hours. In each instance, the trouble has been of a minor nature.

Designed for unattended operation, the unit is equipped with automatic controls that permit it to speed up or slow down while maintaining constant processing pressure and volume. Other special controls watch over the unit to shut it down should any unusual operating conditions develop.

Bring your compression problems to Beaird. Our gas engineers are available to help you find an economical solution.

Packaged Compressor for —

"VEST POCKET" GASOLINE PLANT



Rowan and Hope compressor station, Sweetwater, Texas—equipped with a Beaird-Ingersoll-Rand 10SVG 550 h.p. Four Cycle gas engine driven compressor, Young radiator and all necessary equipment and controls. Other sizes 110 to 660 h.p.

THE J. B. BEAIRD COMPANY, INC.

Shreveport, Louisiana

BEAIRD

MACHINING • MANUFACTURING • STEEL WAREHOUSE

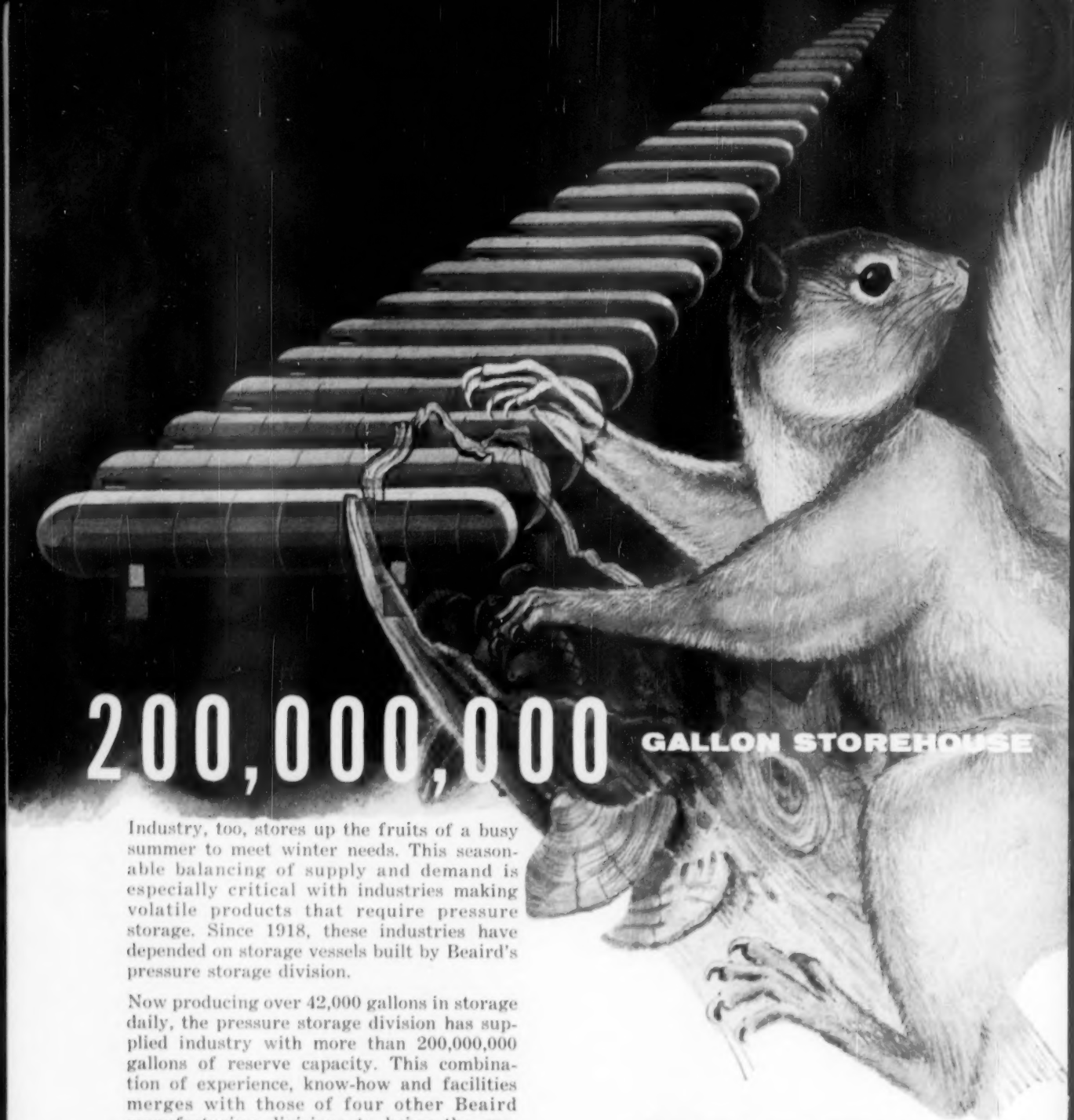
PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS



200,000,000 GALLON STOREHOUSE

Industry, too, stores up the fruits of a busy summer to meet winter needs. This seasonable balancing of supply and demand is especially critical with industries making volatile products that require pressure storage. Since 1918, these industries have depended on storage vessels built by Beaird's pressure storage division.

Now producing over 42,000 gallons in storage daily, the pressure storage division has supplied industry with more than 200,000,000 gallons of reserve capacity. This combination of experience, know-how and facilities merges with those of four other Beaird manufacturing divisions to bring the customers of all five the finest products for their industries.

Let us quote on your standard or special storage requirements. Write: The J. B. Beaird Company, Inc., Shreveport, Louisiana.

Beaird's pressure storage division serves refineries, LP-Gas marketers, anhydrous ammonia manufacturers, chemical processors — and many allied petro-chemical industries.

PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

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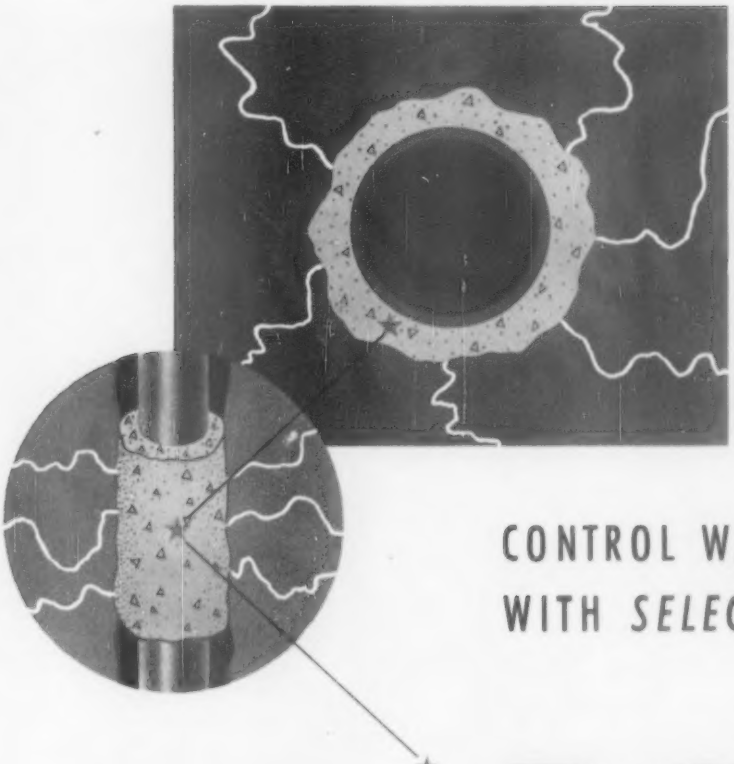
LP-GAS SYSTEMS

BEAIRD

MACHINING
FABRICATING
STEEL WAREHOUSE



CONTROL WATER WITH *SELECTIVE* SQUEEZING

HALLIBURTON'S DOC

(DIESEL OIL CEMENT)

Selective squeezing, a proved remedial technique using Halliburton's DOC, now makes it possible to form an effective seal only in those areas where formation waters are present. A unique mixture of diesel oil, cement and a powerful surface active agent, DOC is unaffected by time, temperature and non-aqueous fluids. DOC will not set until penetrated by water in the well – giving a dependable method of selective cementing under the roughest conditions.

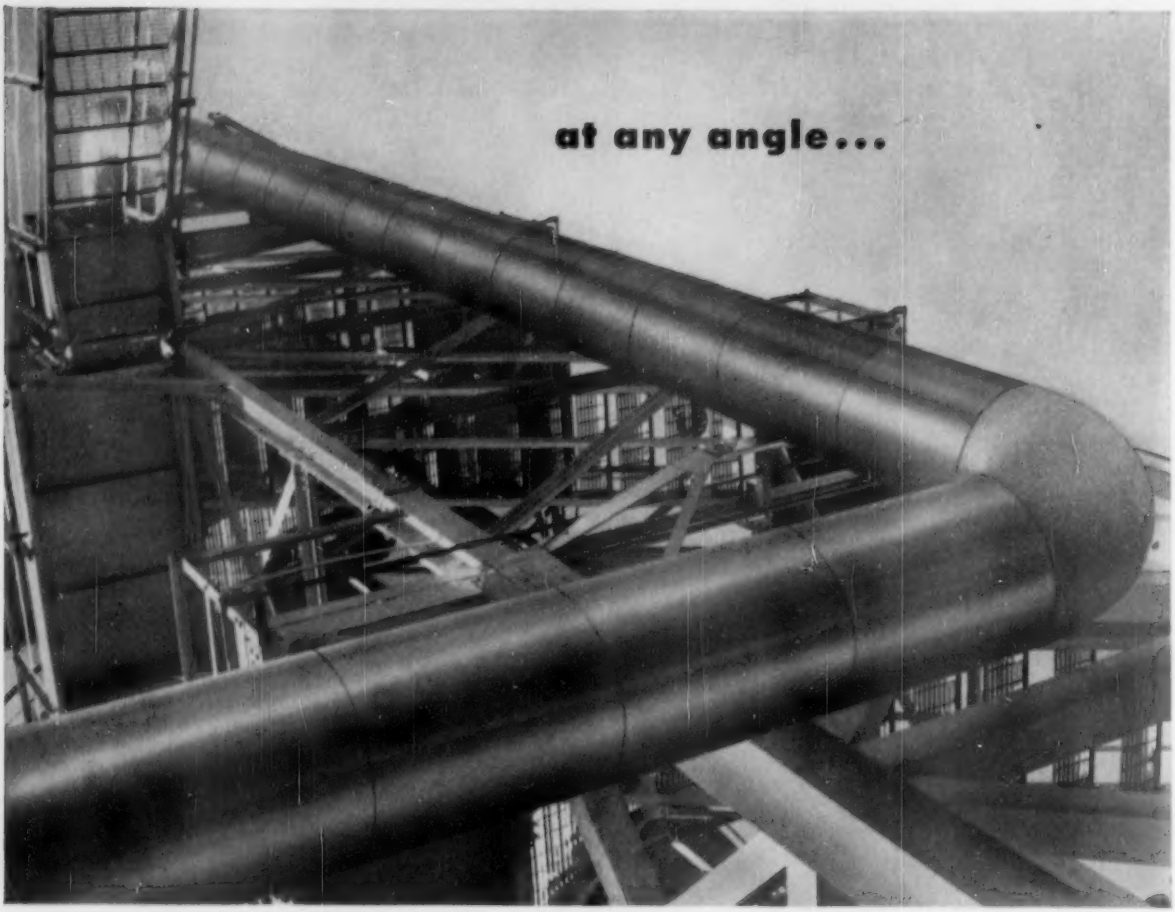
In a Louisiana well that had been unsuccessfully treated ten times with water base cement, 100 sacks of DOC were squeezed at 12085'-12087'. Production results–300 BOPD with no water. A Kansas well with casing corroded through the Dakota water zone from 425'-1200' was squeezed with 250 sacks of DOC. Completion results–casing successfully repaired and tested to 520 psi. And an Oklahoma well that was initially flowing 35 BOPD and 35 BWPD through perforations at 3397'-3391' was squeezed with 100 sacks of DOC. Production results–50 BOPD with no water.

These typical field results explain why DOC is so often selected to handle the water exclusion jobs that are too tough for water base slurries. With unequalled squeezing characteristics – heavier weight, high compressive strength, unlimited thickening time and selective setting – DOC may be able to give you first-time remedial results that mean more profitable production. For economical help on any squeezing job, call your local or district office of the Halliburton Oil Well Cementing Company.

HALLIBURTON

CEMENTING SERVICES

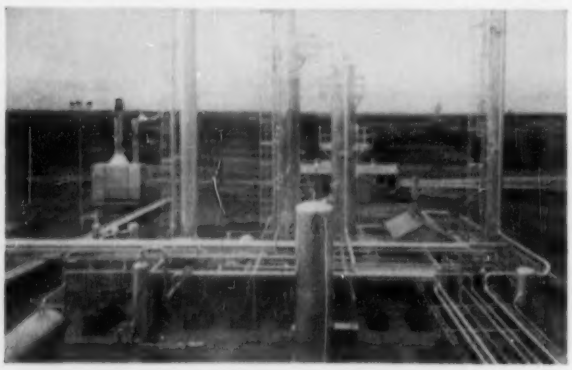
211 SERVICE CENTERS – JUST MINUTES AWAY FROM ANY RIG



it's easier to insulate pipe with Unibestos®

NO MATTER HOW COMPLEX THE PIPELINE, Unibestos insulation makes installation simpler. It's easily cut, mitered, or grooved for effective insulation of bends, expansion joints, ells, tees and other fittings.

Unibestos' unique construction provides greater protection against heat loss—even at the difficult joints—than other nonfibrous insulation. Amosite, the African long-fiber asbestos, gives Unibestos the extra strength to resist shock and vibration. And Unibestos has excellent chemical stability...withstands moisture, steam, acid or chemical fumes.



STANDARD PRODUCTION SIZES

Unibestos Pipe Insulation is regularly made in 3-foot lengths for pipe sizes from ½" through 24", in standard thicknesses through 5". Unibestos Block Insulation is made in 6", 12", 18" or 36" widths and in thicknesses from 1" through 3" in ½" increments.

For complete information, write for descriptive Bulletin 109C

UNARCO®

UNION ASBESTOS & RUBBER COMPANY

1111 West Perry Street • Bloomington, Illinois

Guiberson
Casing Swab
with "GW" Cups

FLEXIBILITY

that means every-drop casing swabbing!

GUIBERSON "GW" CUPS

**hug casing wall—
automatic seal,
controlled pipe contact**

- Unequalled in rough or mixed casing strings
- Stout, flexible lip brings up every drop
- Won't down-swab or hang on casing collars
- Perfect for unloading shallow wells
- Abrasion resistant compound — takes up own wear
- Performs better — lasts longer — costs no more
- Interchangeable on the Guiberson Casing Swab

Guiberson Swab with "GW"
and "K" cups offers greatest
size range on the market.

Better Be Safe Than Sorry!

THE
GUIBERSON
CORPORATION
ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.
Sold By Leading Oil Field Supply Stores Everywhere

BENDIX MAGNETOS

Standard equipment for leading engine builders

INGERSOLL-RAND

CLARK BROS.

COOPER BESSEMER

WORTHINGTON

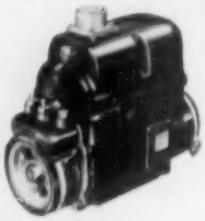
CHICAGO PNEUMATIC

BOVAIRD-SEYFANG

ENTERPRISE

NATIONAL SUPPLY

Heavy-Duty Coil



LAR Magneto

Bendix

the most trusted name in **MAGNETOS**

The Scintilla Division of Bendix is proud of the fact that the list of users of the Bendix LAR Magneto forms a veritable "who's who" of renowned engine builders. These manufacturers have introduced the many new designs and innovations necessary to satisfy modern industry's increasing requirements.

We at Bendix-Scintilla have had the privilege of sharing in these exciting new developments—by providing completely modern ignition for today's compact, high compression industrial engines.

When you buy engines, be sure to specify Bendix-Scintilla ignition.

SCINTILLA DIVISION OF BENDIX AVIATION CORPORATION
SIDNEY, NEW YORK

Export Sales and Service: Bendix International Division, 205 East 42nd St., N. Y. 17, N. Y.

FACTORY BRANCH OFFICES: 117 E. Providencia Avenue, Burbank, California • 512 West Avenue, Jenkintown, Pennsylvania • Stephenson Building, 6560 Cass Avenue, Detroit 2, Michigan • 5906 North Port Washington Road, Milwaukee 17, Wisconsin • American Building, 4 S. Main St., Dayton 2, Ohio • 8401 Cedar Springs Road, Dallas 19, Texas Boeing Field, Seattle 8, Washington • 1701 "K" Street, N. W., Washington 6, D. C.

Bendix
SCINTILLA DIVISION

Bendix
AVIATION CORPORATION

CABOT pumping units get better all the time!

Ask the J&L men you know what you could reasonably expect to gain from Cabot units.

A RUBBER BEARING joins the walking beam and pitman — torsional deflection instead of friction. Nothing to lubricate. Wonderful shock absorber. Patented.

CRANK BALANCE that one man can adjust without a truck and a crew.

REDUCTION employs Sykes-cut herringbone gears, flood lubricated. No oil seals used or needed on reducer shafts. Timken and Hyatt roller bearings.

It has always been possible to lift a barrel of oil for less money with a simple, sensible Cabot.

Jones & Laughlin
STEEL CORPORATION
SUPPLY DIVISION — TULSA, OKLAHOMA
Serving The United States and Canada

J&L STEEL

You can do it CHEAPER with

UTILITY *Electric Power*

Efficient, Dependable Low Cost Power!

Utility Electric Power gives you just that . . . PLUS MORE! Wherever oil is lifted, moved, or refined, Utility Electric Power will do a great job! Low initial cost . . . low maintenance and operating costs . . . complete dependability around the clock . . . safety, convenience and automatic control to meet your power requirements. Yes, these advantages are yours when **Economical** Utility Electric Power is specified.

Petroleum Electric Power Association

P. O. BOX 2771, DALLAS, TEXAS

ORGANIZED IN THE INTEREST OF GREATER SERVICE TO THE PETROLEUM INDUSTRY

CALL YOUR LOCAL ELECTRIC POWER COMPANY FOR POWER FACTS

NEW DEVELOPMENT BY REPUBLIC RUBBER ALLOWS CONCENTRATED ACIDS TO BE SAFELY CARRIED IN RUBBER HOSE

Youngstown, Ohio—It is now possible to safely conduct concentrated acid solutions in rubber hose, the Republic Rubber Division of Lee Rubber & Tire Corporation announced recently.

Exhaustive field and laboratory tests show that Republic Acid Hose, with a tube containing Hypalon, will conduct concentrated acid solutions without deteriorating the hose.

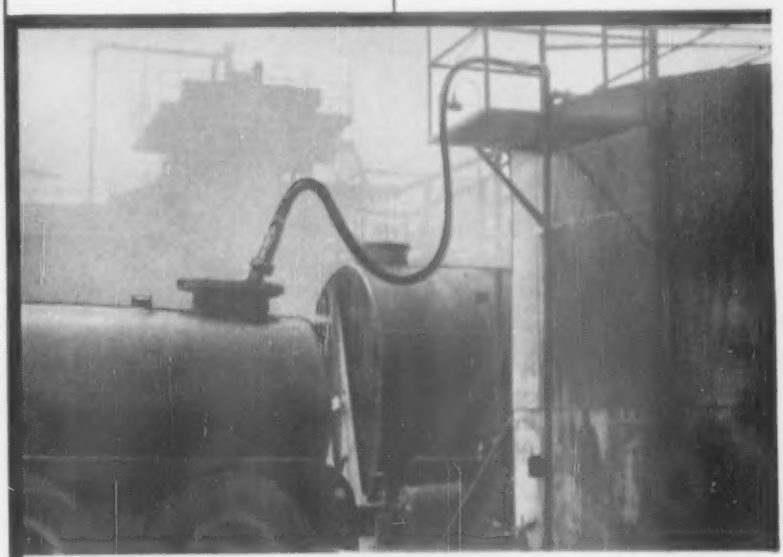
Listed below are chemicals which can be safely handled by Republic Acid Hose with a Hypalon Tube:

Liquid Anhydrous Ammonia at Room Temperature.
Chlorine Dioxide—2 to 14% at 150° F.
Chrome Plating Solution at both R T* and 158° F.
Chromic Acid 50% at R T.* 158° F. and 200° F.
Chromic Acid Concentrated at R T.*
Hydrofluoric Acid 48% at R T* and 158° F.
Nitric Acid 10%.
Nitric Acid 70% at R T* to 122° F.
Nitric Acid Fuming Serviceable for 4 hours to 3 days.
Phosphoric Acid 85% at R T* to 200° F.
Potassium Hydroxide (Concentrated) at R T.*
Sodium Dichromate 20% at R T.*
Sodium Hydroxide 50% at R T* and 158° F.
Sulfuric Acid 10% at R T.*
Sulfuric Acid 40% at 150° F.
Sulfuric Acid 50% at R T* to 200° F.
Sulfuric Acid 60% at 158° F.
Sulfuric Acid 70% at 158° F.
Sulfuric Acid 80% at 158° F.
Sulfuric Acid 95.5% at R T.*

*Room Temperature

Republic is able to furnish Acid Hose with a Hypalon Tube in both Suction and Discharge Hose in a wide variety of sizes for use where a superior grade of Acid Hose is advisable from a safety, as well as economic, standpoint.

It was also stated at Republic Rubber that their engineers are working on problems involving other types of acids, and that they are willing to work on any special application that would help the industrial user.



DANGER! SULFURIC ACID

This tank truck, working at a leading southern phosphate company, is discharging 98% SULFURIC ACID through a hose manufactured by Republic Rubber —

REPUBLIC ACID HOSE

Here is the astounding truth —

The length of Republic ACID HOSE (with a Hypalon Tube) pictured above has conducted 98% Sulfuric Acid at rate of 3 tank cars a week FOR THE LAST FOUR MONTHS! The hose, after four months' service, was still in good condition but was replaced for safety's sake.

Previously, this southern company had used regular acid hose for only **one week**, or only 3 tank car loads, before replacement became necessary. The use of Republic Acid Hose with the Hypalon Tube lowered the cost of this operation by a substantial amount.

If you transfer acid via rubber hose, ask your local Republic Distributor to help you select the right Republic Acid Hose for your job. His name may be found in the Yellow Pages of your phone book, or write:

REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS

JOB ENGINEERED FOR

HYDROCARBON LIQUIDS

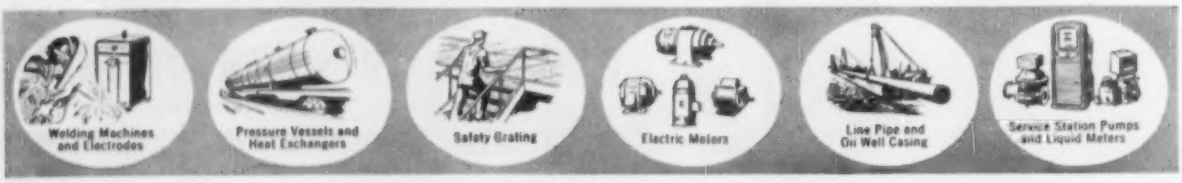
Typical installation of SMITHway Vertical Turbine Pumps at a West Coast airport for a large oil company.

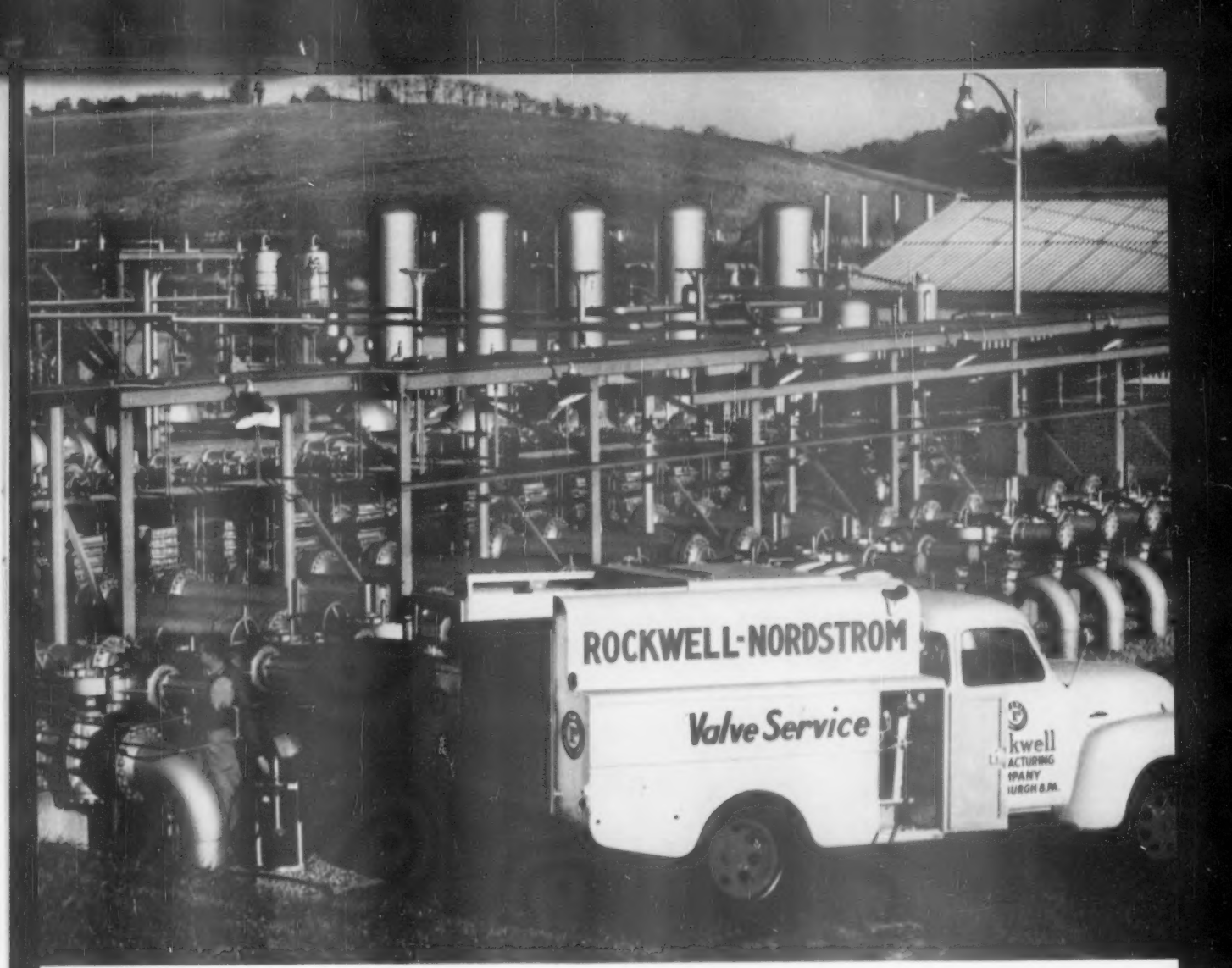
For more economical handling of hydrocarbon liquids get a "Job Engineered" installation. SMITHway short coupled vertical pumps, illustrated, can be used either to serve bulk loading racks at commercial airports or for high pressure direct refueling. These pumps are especially designed to handle crude oil, light fuel oil and liquefied gases as well as high octane aviation gasoline and jet fuels.

For complete information, see nearest representative or dealer.

Through research A.O. SMITH *... a better way*

A.O.Smith
CORPORATION
HYDRAULIC PRODUCTS
5715 Smithway St., Los Angeles 22, California
Offices in principal cities
International Division, Milwaukee 1


Welding Machines and Electrodes
Pressure Vessels and Heat Exchangers
Safety Grating
Electric Motors
Line Pipe and Oil Well Casing
Service Station Pumps and Liquid Meters



Investment in Economy

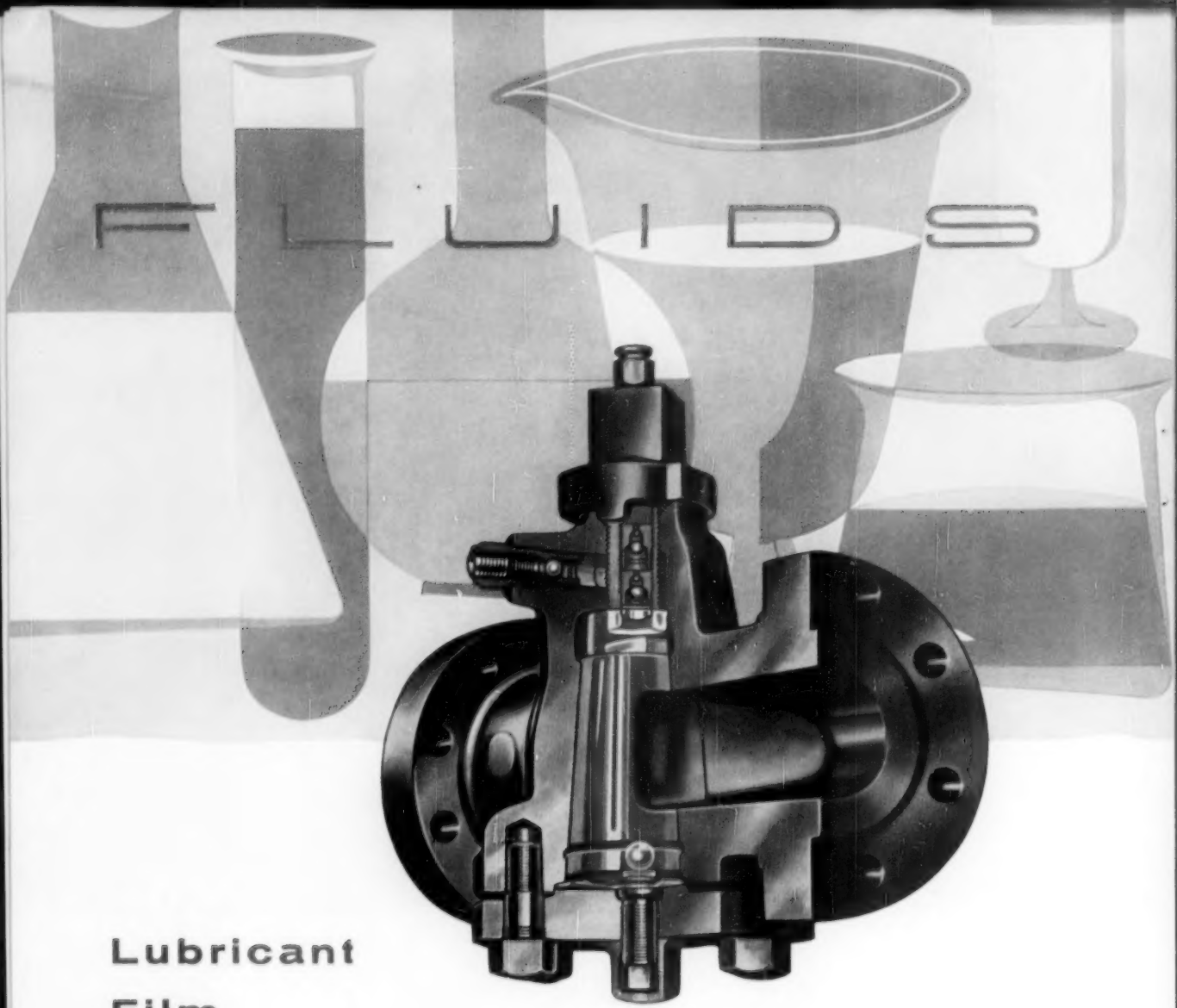
For forty years Rockwell-Nordstrom, the *original* lubricated plug valve, has built a reputation for valve economy. This year, Rockwell-Nordstrom users have even greater opportunities for valve economies through Rockwell's new mobile maintenance service, which is being made available on a contract basis.

Using the most up-to-date lubrication equipment on special Valve Lubrication Trucks, trained personnel will service all your Rockwell-Nordstrom valves on a schedule adapted to your individual requirements. These specialists will advise you on the correct Rockwell-Nordstrom lubricant for each of your services, and instruct your men on proper valve care that will allow further savings through greater efficiency and longer life.

Like Rockwell-Nordstrom valves themselves, this new Rockwell Contracted Maintenance Program has a single purpose: to give you the best valve service you've ever had, at the lowest cost per year. For complete information, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF



Lubricant Film Stops Metal-Hungry Fluids

Corrosive and erosive liquids are the nemesis of ordinary valves. But the thin, tough film of pressurized lubricant in Rockwell-Nordstrom valves forms an impregnable armor plating against them. And lubricant in the Sealdport* grooving provides a pressure seal that is dependably leak proof.

On liquid lines—or on any service—Rockwell-Nordstrom valves and lubricants will do a better job, longer, for less money. For complete information related to your valve problems, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

*a registered trademark of Rockwell Manufacturing Company

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

Why is Dunham Tanks forging ahead?

(NO. 8 IN A SERIES OF 10 ADS.)

NEW, ADVANCED FREE WATER KNOCKOUT!

better because...

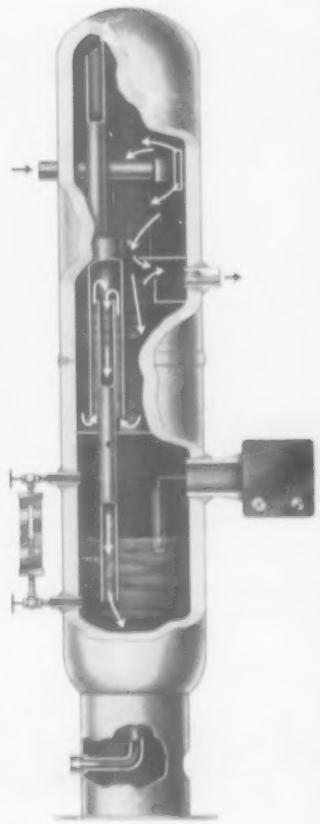
No distillate loss through water outlet! Removes all free water without any possibility of distillate flowing through the water outlet even with water control failure.

Does not interface liquid level control.

100% efficient under highest pressures! Removes free water from 1000# to 6000# or even higher pressures of gas distillate streams at well head pressures.

Lower initial installation, maintenance and operation **costs!**

For more economical, efficient and modern oil field production equipment call your Dunham Tank Representative.



Products:

Welded and Bolted Steel Tanks, Steel Stairways and Walkways, Vertical and Horizontal Oil & Gas Separators, Emulsion Heaters and Treaters, Indirect Gas Heaters, Cold Separation Units, Two Stage Separation Units, Gas Dehydration Units, Three Phase Separators, Free Water Knockout, Servel Refrigeration Units and LeRoi Compression Units.

ANDERSON-DUNHAM, INC. DUNHAM TANKS TANK DIVISION

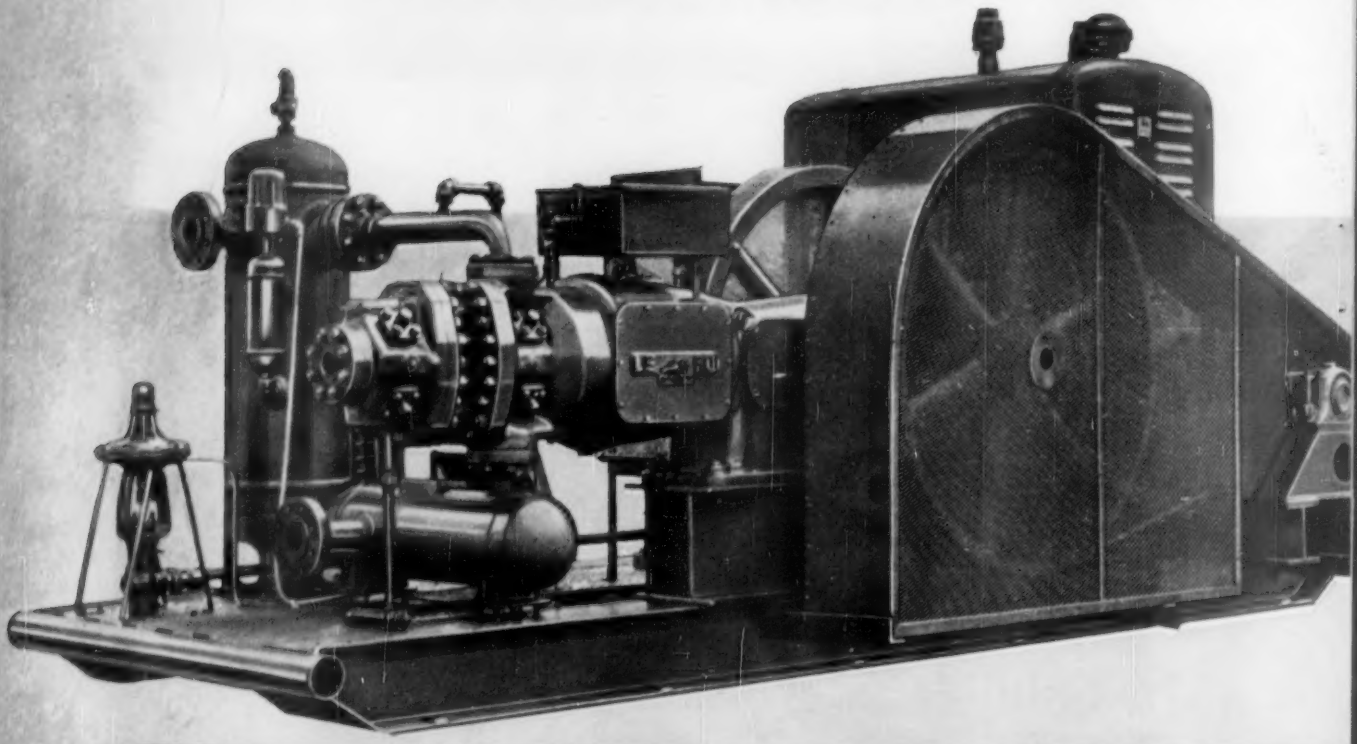
ST in oil field production equipment.

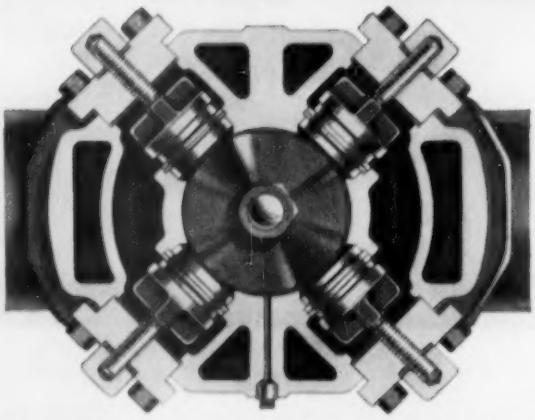
DUNHAM TANKS

Division of Anderson-Dunham, Inc., Baton Rouge, La.

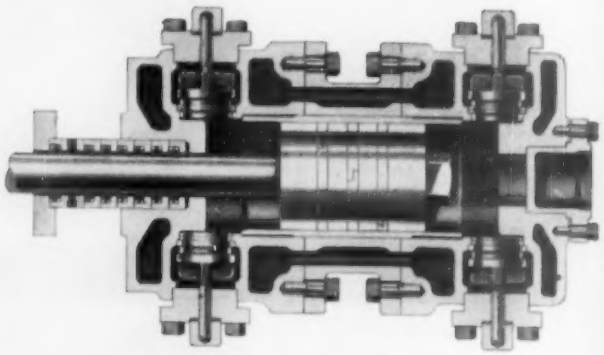
Plant: Minden, La. Sales and Service: Shreveport, La.; New Orleans, La.; Lafayette, La.; Perry, Okla.; Seminole, Okla.; Tulsa, Okla.; Ardmore, Okla.; Odessa, Tex.; Corpus Christi, Tex. (Lester Moore Tank & Supply Co.); Houston, Tex.; and, Natchez, Miss.

LeRoi Announces:





AIR CUSHION VALVE—consists of five parts—seat, stainless steel valve disc, guard, spring, and the retainer ring that locks the guard and seat together. There are no bolts or screws in the entire valve assembly—nothing to jar loose or "burn" fast. Both assembly and disassembly are quick and easy. A screwdriver or a piece of strip steel is all that is needed to unlock the parts.



PISTON—is of the core-box type. It is equipped with three-piece piston rings, two packing rings, and a tension ring fitted into each groove of the piston.

New Gas-Booster Compressor Line

Now you can get a semi-portable, package-type, gas-gathering compressor. Built, backed, guaranteed, and serviced by one organization.

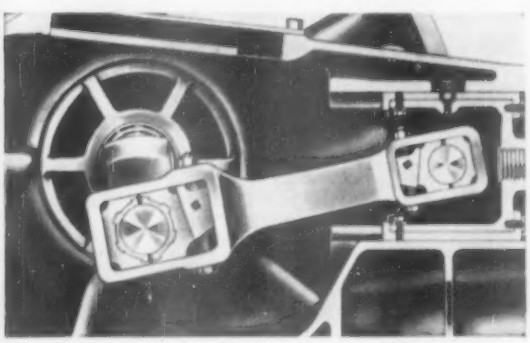
Le Roi's new gas-booster line consists of 5-, 7-, 9-, 11-, and 13-inch stroke machines ranging in size from 10 to 300 hp.

They are built with the same care as Le Roi oilfield engines, using the same precision manufacturing techniques.

Generally speaking, the compressor is of the heavy-duty oilfield type. It has a sectionalized, gas compressor cylinder that can be disassembled without disturbing any pipe connections. Moreover, the cylinder is designed so that the intake is on top and the discharge on the bottom to provide for self-scavenging of any condensate — intake and discharge valves are interchangeable. And, of course, the power unit is a modern Le Roi oilfield engine.

Additional features are: Removable cylinder liner in center cylinder section. Oil-tight crankcase with breather. Oil-level gauge for crankcase. Enclosed dust-tight distance piece between cylinder and frame. Metallic wiper rings. Force-feed gas-cylinder lubrication. Metallic-type, full-floating, Micarta stuffing-box packing. (Where pressures are 800 PSIG or over, stuffing-box packing consists of full-floated, leaded bronze.) Micarta piston rings.

Everything has been done in the design of this line of compressors to provide you with units that meet Le Roi's high standards of dependability and efficiency. Let us quote on your compressor needs. Just send information to Le Roi Oilfield Headquarters, 5000 45th West Avenue, P. O. Box 9487, Tulsa, Oklahoma. Give us suction pressure, discharge pressure, and capacity — inlet temperature and "N" value of the gas would also help. In the meantime literature is available — write for your copy.



CONNECTING ROD—made from a steel forging is of the closed-end type that eliminates all breakage of straps or strap bolts. It is fitted with removable crank and crosshead pin bearings. The crank pin bearing, in halves, is malleable iron, babbitt-lined. The crosshead pin bearings are solid bronze halves.

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 14, Wisconsin
Oilfield Headquarters: Tulsa, Oklahoma

PORTABLE AIR COMPRESSORS

TRACTAIR

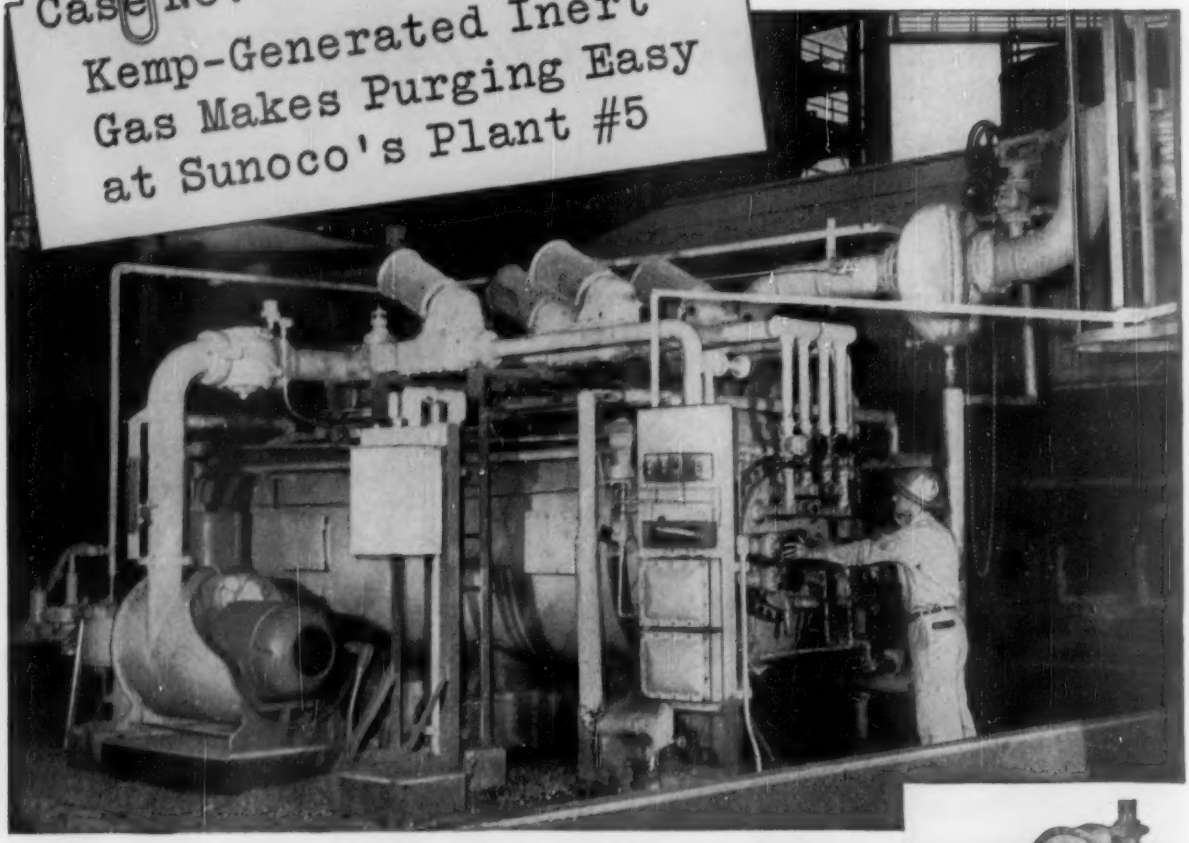
STATIONARY AIR COMPRESSORS

AIR TOOLS

ENGINES

P-139

Case No. 57
Kemp-Generated Inert Gas Makes Purging Easy at Sunoco's Plant #5



How Sun Oil's "Magic Mill" at Toledo operates with 'round the clock safety

There's no *one* word that strikes terror in the hearts of oilmen everywhere more quickly than F-I-R-E! To combat this threat at the Sun Oil Co.'s giant refinery at Toledo, Ohio, constant vigilance, checks and inspections are the answer. And the liberal use of inert gas for purging pipelines, tanks and crackers is essential to this safety maintenance.

Kemp selected to do the job

When plans called for *doubling* plant production in 1950, a new Kemp Generator (see above) was installed to insure adequate inert gas production. Fast-starting, easy-to-operate, this Kemp unit more than filled the bill. Today tanks and lines are periodically purged for inspection and cleaning *as often as needed*. And thanks to its 60,000 cu. ft. per hr. Kemp Inert Gas Generator, Sunoco enjoys *exact analysis* inert production that meets all its purging requirements.

Let Kemp help you, too

If you have a purging or blanketing problem, why not let Kemp Engineers give you the same helpful advice used so profitably at Sun Oil's Toledo refinery. It costs you nothing to investigate. And it may save you money. Find out how Kemp's wide range of dependable, low-cost Generators (complete with the latest fire checks and safety devices) offer you the best way to solve your problems.

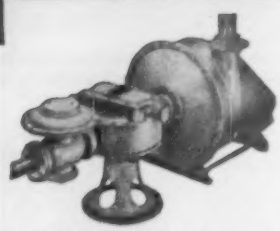
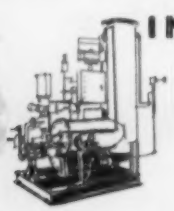


Photo above shows close-up view of Kemp Industrial Carbureter, the heart of every Kemp installation. Assures complete combustion... without waste, without tinkering. Reduces installation costs, simplifies maintenance.

For more complete facts and technical information, write for Bulletin I-10 to: **C. M. KEMP MFG. CO., 405 E. Oliver Street, Baltimore 2, Maryland.**

KEMP OF BALTIMORE



INERT GAS GENERATORS

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If you want friendly, competent service . . . if you like to deal with specialists who know the oil business—and the banking business—then Second National is the oil bank for you.

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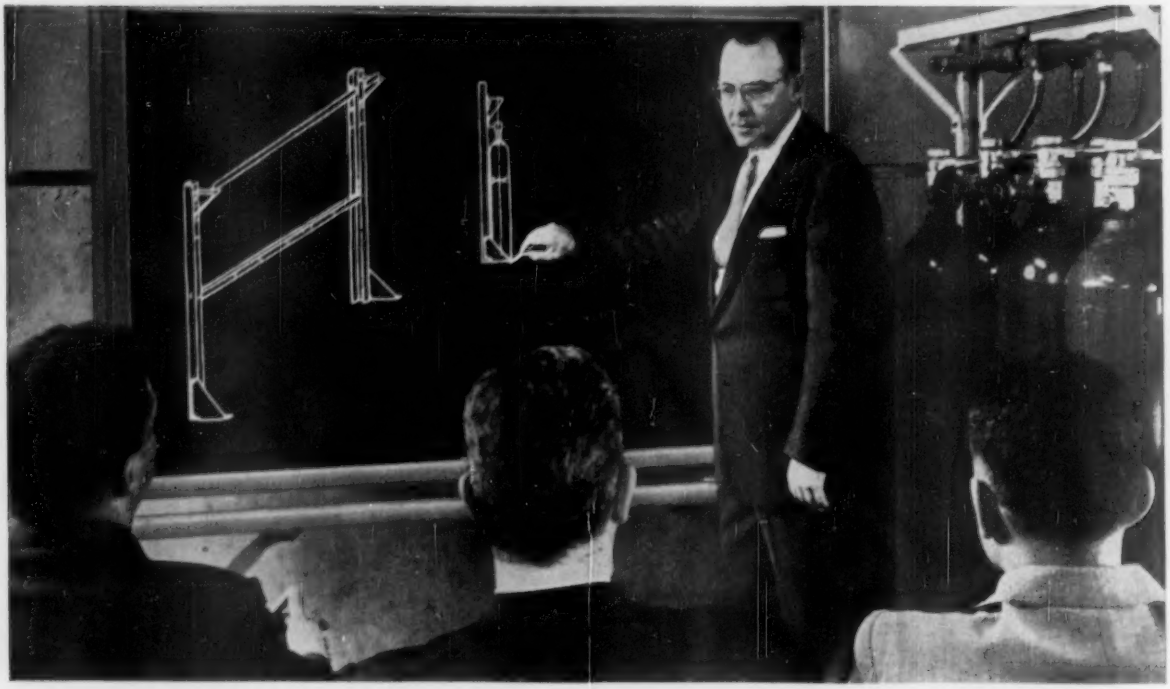

This Kidde Automatic Pressure-Operated CO_2 Extinguishing System is *brand new from the floor up!*

✓ CHECK THESE 10 FEATURES!

☐ **1.** NO FALLING WEIGHTS – No clumsy mechanical triggering methods. Pneumatic or Electrical Control Heads automatically trigger CO_2 cylinders, assure complete discharge!

☐ **2.** SELF-ENCLOSED PARTS – All moving parts of the new Kidde system are self-enclosed to prevent fouling or accidental operation!

☐ **3.** EASIER INSTALLATION – New racking arrangement is pre-drilled at the factory, eliminates need for special hangers, tools or outside material! Can be either "free standing" or wall mount.

☐ **4.** NO PARTS TO REPLACE – Even after a fire, operating parts of the new Kidde system can be re-set with a screwdriver. No parts need be replaced. Refill cylinders and system is ready for operation!

☐ **5.** SIMPLE, THOROUGH TESTING – By merely disconnecting control heads from cylinders, *all* operating parts (other than actual discharge of CO_2 gas) can be tested *in place!*

☐ **6.** QUICK VISUAL INSPECTION – All primary actuating parts fitted with easy-to-read visual indicator. Shows at a glance if system is "set" or "released."

☐ **7.** MULTIPLE PROTECTION – Automatically-operated Directional Valves let you protect more than one hazard from the same bank of cylinders!

☐ **8.** SIMPLIFIED WEIGHING – New racking arrangements lets you weigh CO_2 cylinders right in place without disconnecting them, providing uninterrupted fire protection even while cylinders are being weighed!

☐ **9.** NO OUTSIDE POWER NEEDED – The new Kidde system is completely self-contained, has rate-of-temperature-rise detectors which give sure protection even in case of outside power failure!

☐ **10.** AUXILIARY EQUIPMENT – Also available for use with the new Kidde system are devices for turning power on or off, for opening or closing doors, windows, dampers, etc.

Fully approved by Underwriters' and Factory Mutual Laboratories. Complete details of this revolutionary new system are contained in Kidde's Pressure-Operated System Booklet. Write for your copy today!

Kidde (K Kidde)

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Jenkins designed for trouble-free performance... a

STAINLESS STEEL "Y"

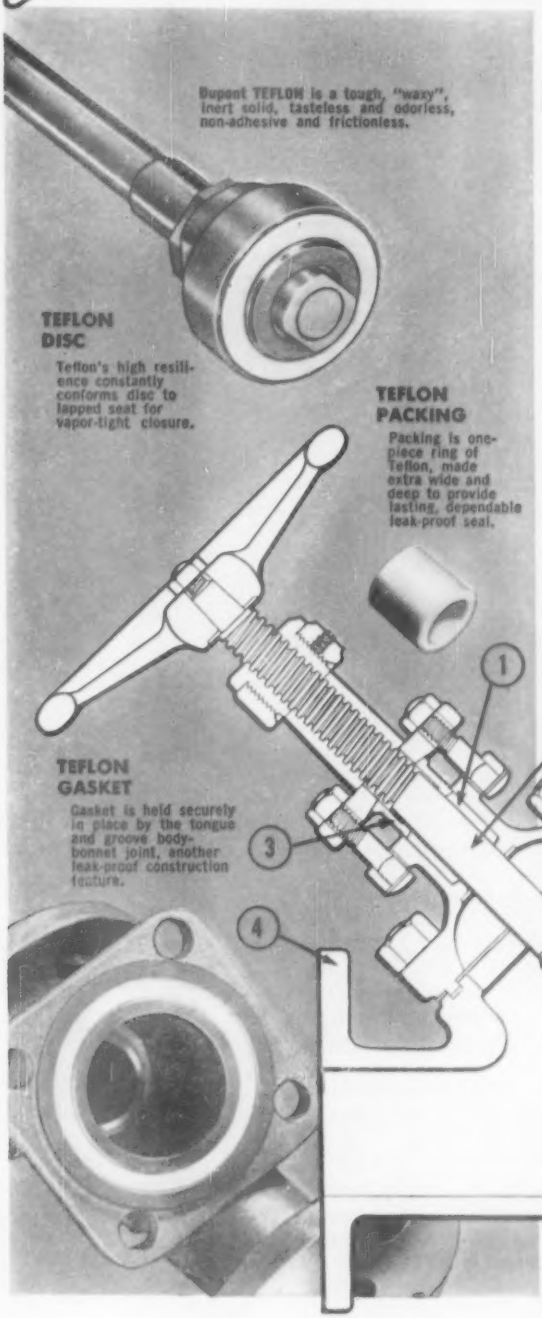
to lower costs in a wider range of

CORROSIVE SERVICES

For food and chemcial plants, and similar services, Jenkins Fig. 1335 "Y" Globe offers many advanced features that will lower operating costs and keep your processing lines trouble-free. The disc, packing, and gasket are tough, resilient Teflon. Tasteless and odorless, it eliminates problems of contamination.

The "Y" pattern permits full flow, nearly equal to that of a gate valve, and also provides the vapor-tight closure and the ease of disc renewal of a globe valve.

Fig. 1335 offers extra value by any test . . . *initial cost, operating efficiency, low maintenance.* You can convert this extra value into *extra savings* on your toughest corrosive services. Call your Jenkins Distributor, or write: Jenkins Bros., 100 Park Ave., New York 17.


Dupont TEFLON is a tough, "waxy", inert solid, tasteless and odorless, non-adhesive and frictionless.
TEFLON DISC
Teflon's high resilience constantly conforms disc to lapped seat for vapor-tight closure.
TEFLON PACKING
Packing is one-piece ring of Teflon, made extra wide and deep to provide lasting, dependable leak-proof seal.
TEFLON GASKET
Gasket is held securely in place by the tongue and groove body-bonnet joint, another leak-proof construction feature.
1
2
3
4

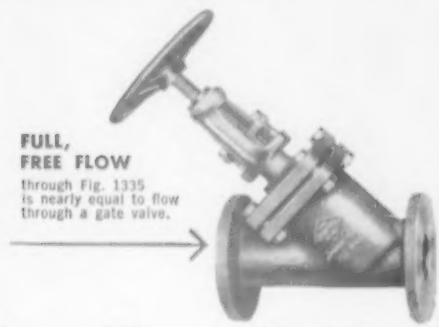


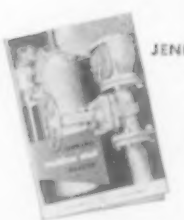
Fig. 1335 "Y" GLOBE
150 lbs. O.W.G. at 500°F
230 lbs. O.W.G. at 100°F
Sizes 1" to 4"

(1) Packing Box—Exceptionally deep and wide to hold optimum size packing.

(2) Spindle—Polished shank, long-operating threads, bevel shoulder for backseating.

(3) Gland—Two-piece for equalized pressure, tight seal.

(4) Flanges—Conform to M.S.S. Standard Practice S.P.42 Specifications.



JENKINS STAINLESS STEEL VALVE BOOKLET illustrates and describes wide range of Jenkins Globe, Gate, Check, and Y Valves, includes selection data, survey forms. Ask for Form 200-A.

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VALVES
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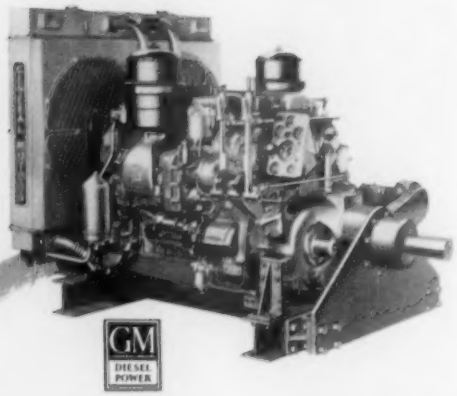

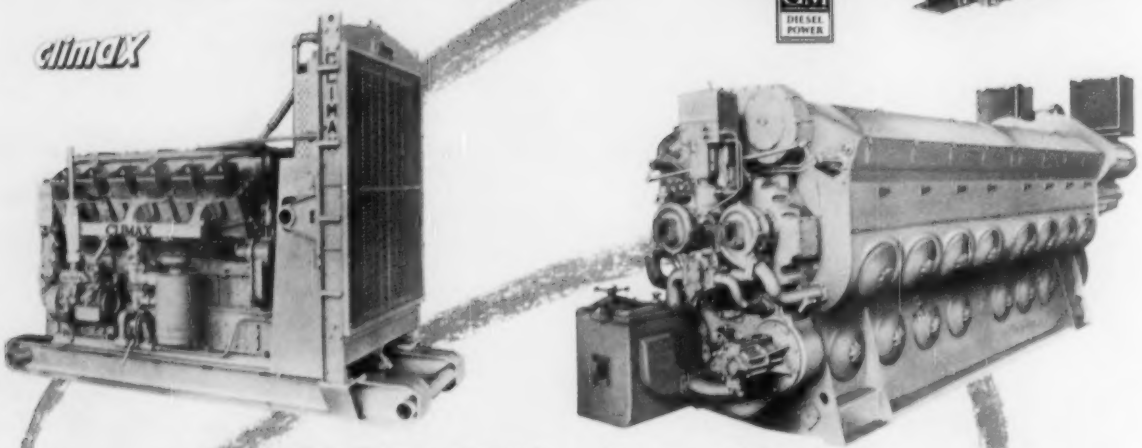

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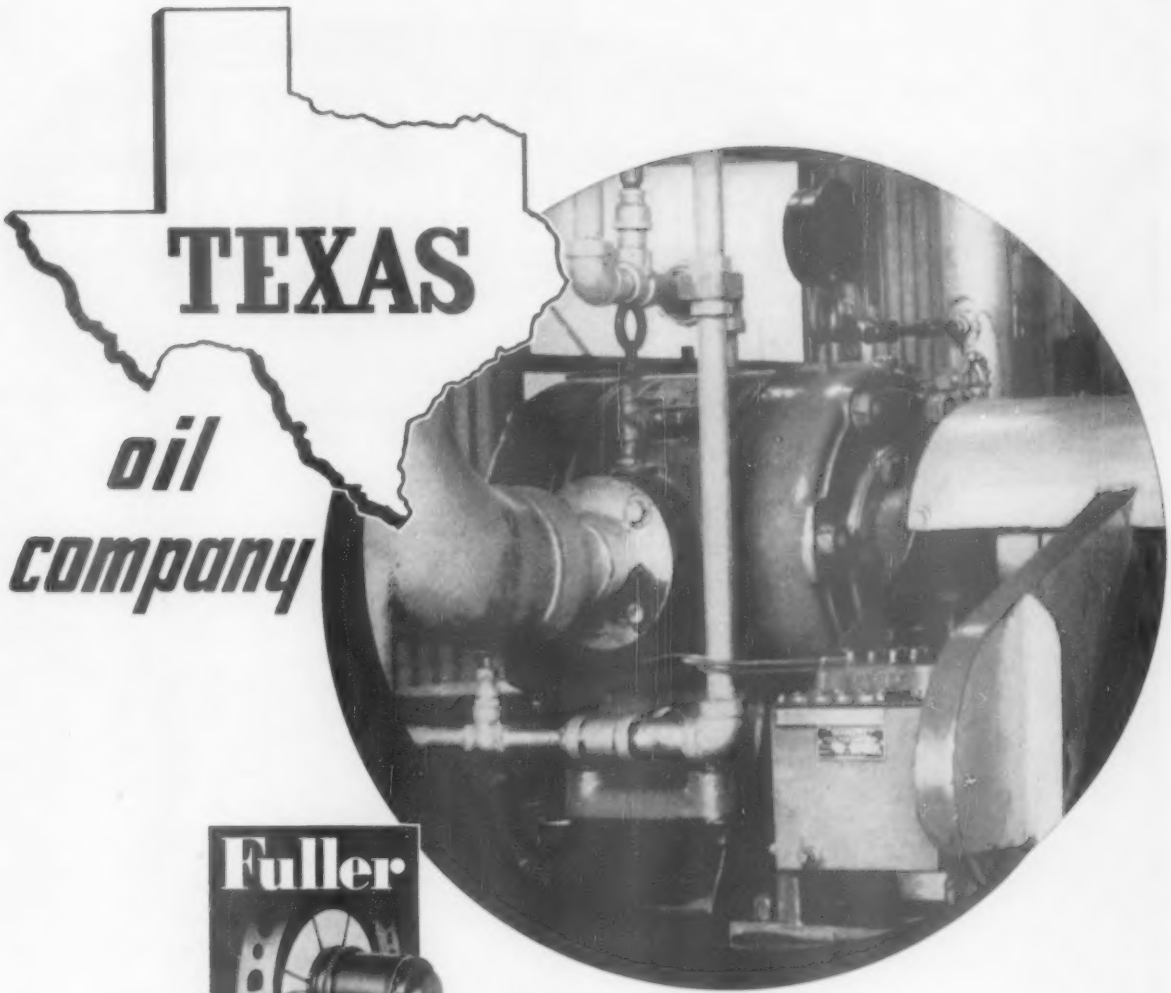

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Fuller Rotary Compressors hold many "key" jobs in the petroleum industry. Illustrated is a Fuller Rotary Single-stage gasoline-vapor booster in a gasoline plant in the Texas Panhandle. This machine has a capacity of 173 c.f.m., referred to intake condition of 75-lb. gage, (1055 free c.f.m.) compressing to 175-lb. gage discharge, operating at 1000 r.p.m.

Fuller Rotary Compressors in the refinery for general plant air, purging gas, and handling butane-butylene, as well as in the field for pressure boosting and gas gathering, have proved their worth, as is evidenced by the many machines in daily use in practically every oil-producing section of the country.

Simplicity of construction has proved to be one of the important factors . . . the only moving parts being the rotor, bearings, and blades. No valves to leak, no seats to grind, results in maintained capacity for the life of the machine. A simplified direct drive eliminates power transmission losses. For further information, write to Fuller Company, Catasauqua, Pennsylvania.

Fuller *Pioneers of high-efficiency rotary compressors*

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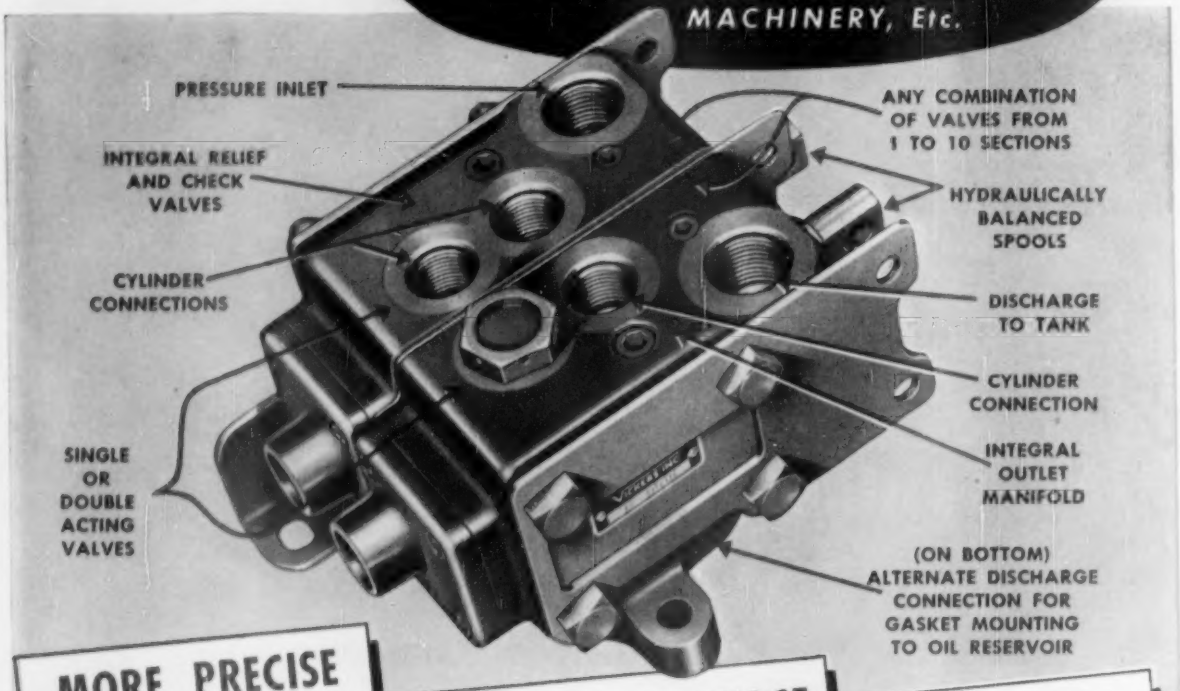
NEW! Series CM11 VICKERS® MULTIPLE UNIT VALVES

For MATERIALS HANDLING EQUIPMENT, FARM TRACTORS, BUCKET LOADERS, CONSTRUCTION and MINING MACHINERY, Etc.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MORE PRECISE CONTROL
Improved Metering Characteristics

REQUIRES LESS SPACE
New Combination Operating-Valve and End-Plate Sections

LOWER COST
Simplified Design and Construction

New, compact, more versatile design of valve. End sections combine in one casting the inlet or outlet manifold plate together with any operating-valve section. Inlet section also contains relief valve. Individual outlet plates available for single unit valves. Single- and double-operating valve sections can be added between end sections as needed. Valve can be adapted for tandem (series) operation. Single-acting valves available for either direction of lever shift.

Other features include protection of pump from reverse flow during shifting . . . three point mounting for more simple installation . . . cylinder connections with ¾-16 N.F.-2 straight threads (AND 10050 type) which conform to SAE standards help insure leak-proof connections . . . optional outlet ports in end section so valve can be gasket mounted to the oil reservoir or pipe connected. Designed for use with Vickers Series V-200 Vane Pumps (up to 11 gpm), the CM11 Valve can be used up to 2000 psi working pressure. For further information write for Installation Drawing M168643.

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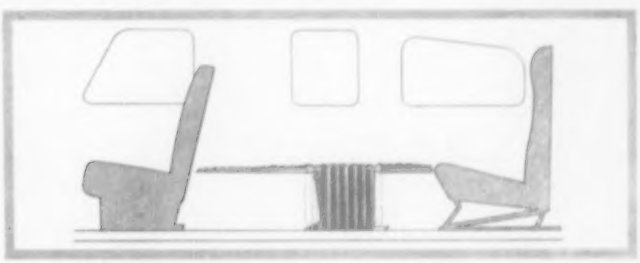
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Twin Bed comfort

in the NEW, BIGGER AERO Commander 560-A

LONGER • ROOMIER • MORE COMFORTABLE

Twin-bed comfort is but one of the flexibility features made possible by the longer, roomier cabin of the new 5-7 place Aero Commander 560-A. The optional hassock seat unfolds in seconds to provide a seat back, a chaise longue or a comfortable bed for the flying executive.



For complete information contact your Aero Commander distributor or write for Catalog 120-A

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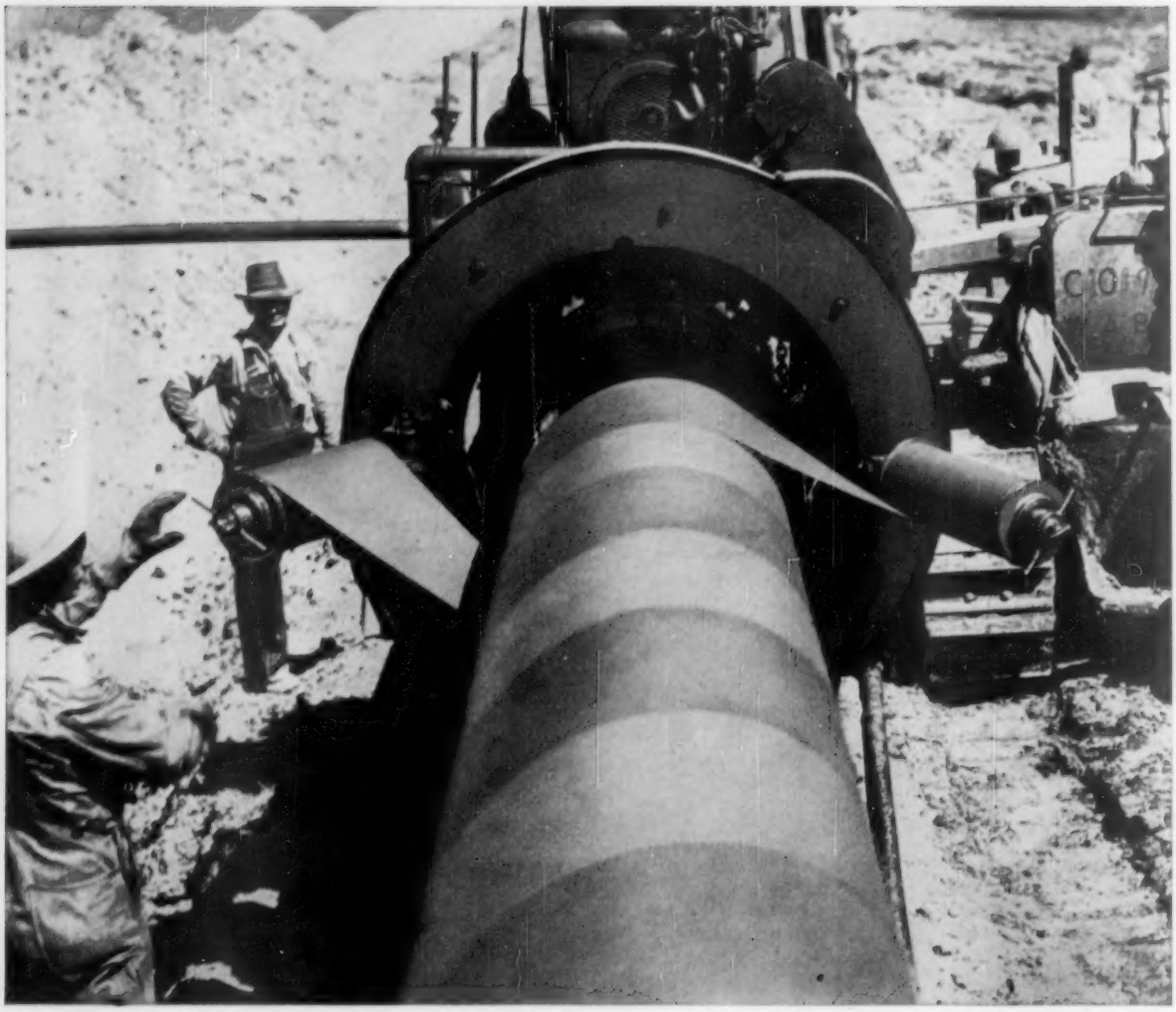

wrapped . . . for keeps

Unaffected by organic soil conditions, Barrett Pipeline Felt forms a perfect bond with coal-tar enamel to provide added strength and resistance to impact shocks and soil stress effects. Made to exacting standards, this coal-tar saturated felt is compatible with the famous Barrett Primers and Enamels . . . and is, without question, the best reinforcing wrapper for protecting capital invested in pipe lines.

Pipe lines protected with Barrett Enamel and Coal-tar Saturated Asbestos Felt have been removed after long periods of service and relaid in other locations without removing the old coating, or expensive reconditioning; a first rate testimonial to the ability of this wrapper to shield effectively the enamel from displacement, penetration, shear, and other soil and pressure stresses. The use of Barrett Pipeline Felt will prolong the life of steel pipe—*under the toughest conditions*—while increasing its cost by only a small fraction.

And when you specify Barrett, you get the expert assistance of the Barrett Technical Assistance Group right from the planning stage until the job is finished. In the field, the Barrett Service Representative is available for "on-the-job" assistance in the proper methods of handling and applying coating material.

We welcome the opportunity to place the Barrett Technical Service Group at *your* service—or to send you further information concerning Barrett Asbestos Pipeline Felt. Phone, write, wire Barrett.

Approved Barrett Applicators are available for protecting pipe in coating plants, yards, in the field, or special work throughout the country. BARRETT DIVISION, Allied Chemical & Dye Corporation, 40 Rector Street, New York 6, N. Y. In Canada: The Barrett Company, Ltd., 5551 Saint Hubert Street, Montreal, Quebec.

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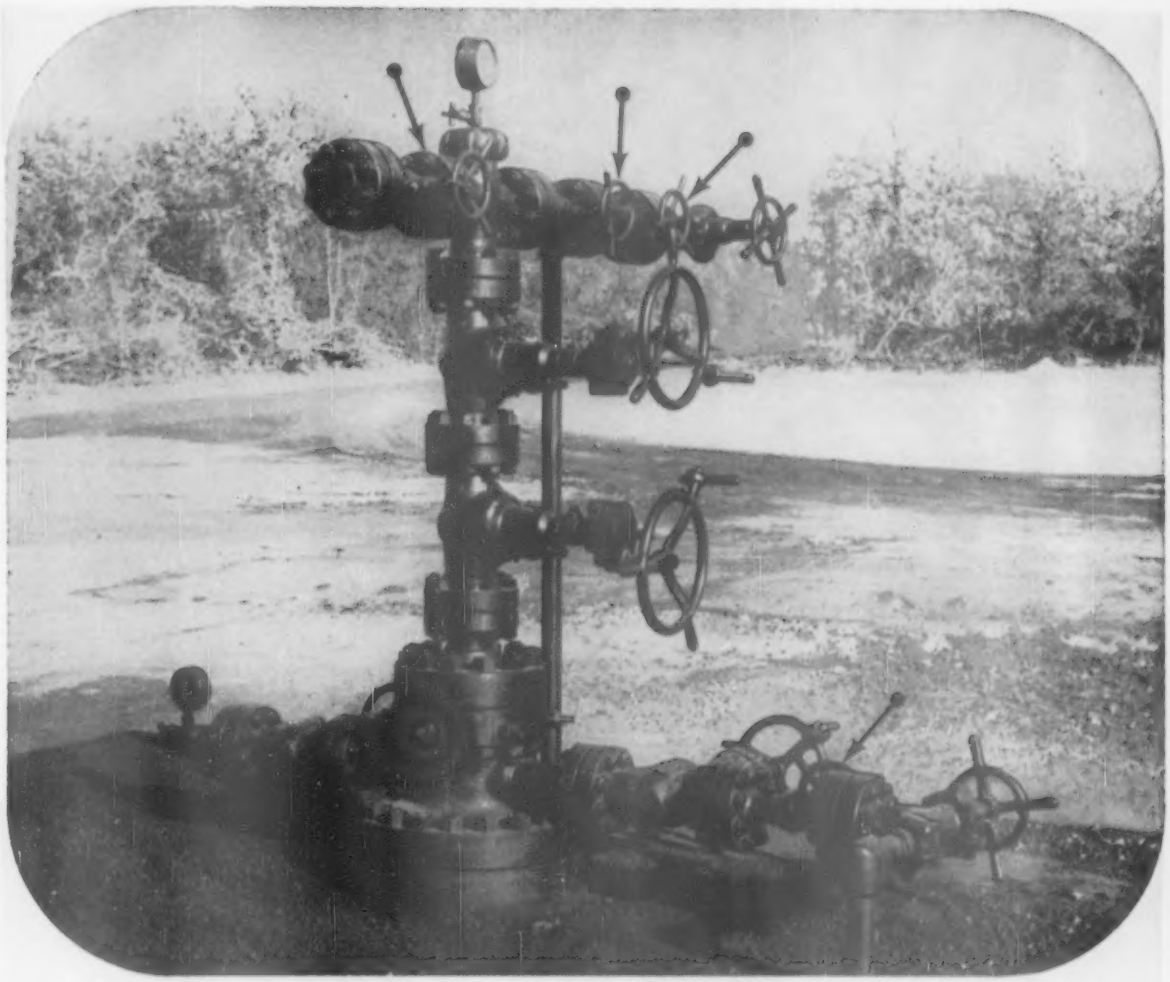
BARRETT PROTECTIVE COATINGS



Sure way to avoid Flowdowns

You can't use more economical valves in your production operations than Orbit forged steel Production Valves. They are designed and built for continuous heavy duty service.

Maintenance is reduced to a minimum, even in the roughest service, because the Orbit principle of seating does not require a lubricant to shut-off pressure.

Opening and closing operations are short and easy. Lubrication is only occasionally required, and then but at two points, to insure positive, easy, and fast action at all times.

The owner of the above 10,000 pound test surface installation has further availed himself of the savings Orbit provides by using four Orbit Venturi Type 2" x 1" wing valves instead of four full opening 2" valves on the tubing wings. A total savings to operator, in this instance, of $605.00.

Orbit manufactures a full line of forged steel Production Valves, from 1" to 4"; working pressures starting at 500 pounds Maximum Service Pressure Rating, to and including 5,000 pounds Maximum Service Pressure Rating both *carbon* trim and *stainless* trim.

Orbit forged steel Production Valves are available through your favorite Well Head manufacturer.

ORBIT VALVES ®

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ORBIT VALVE COMPANY

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Adjustable-speed Gýrol Fluid Drive

controls the flow in catalytic reforming processes

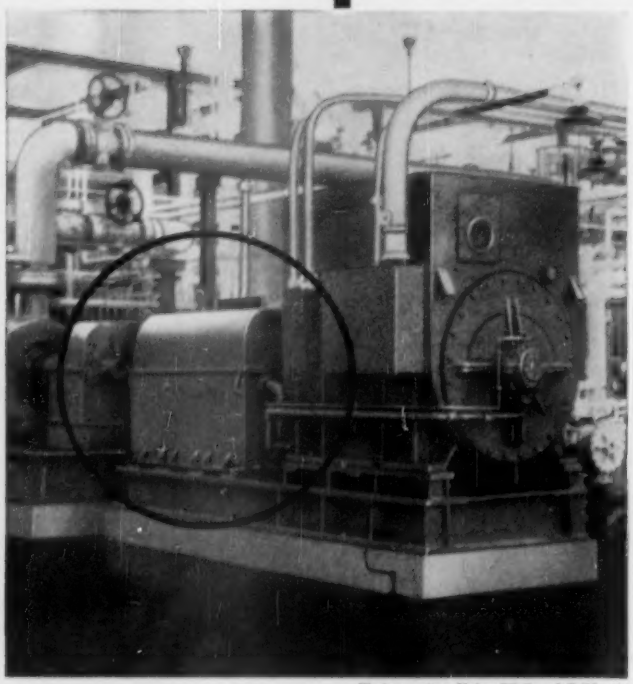


Photo courtesy Union Oil Co. of California

Unit shown is a 4000 hp, 1800 rpm, size 315, type VS, Class-6 Gýrol Fluid Drive equipped to automatically regulate the speed of a centrifugal compressor handling variable-density gases.

Accurate control of the flow of gases and fluids is the key to the successful operation of a catalytic reforming plant. Because its speed is *adjustable*, American Blower Gýrol Fluid Drives can vary the flow rates of compressors and pumps of all sizes and types — *as needed*. Consider these inherent advantages of Gýrol Fluid Drive:

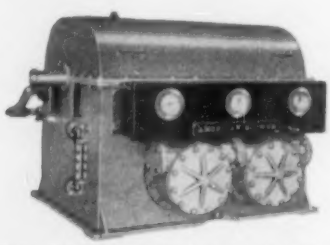
- Provides infinite and accurate pump speed adjustment over a wide range
- Simplifies starting equipment — provides no-load starting
- Eliminates problem of "gumming" which may occur with mechanical dampering
- Saves steam needed for process work through use of squirrel-cage, constant-speed electric motor
- Permits automatic control. Flow rates can be automatically regulated by simple movement of one push-pull control rod

Whatever your method of catalytic reforming, use Gýrol Fluid Drives for flow-rate control. Call your nearest American Blower Branch Office for data.

Traction-type Fluid Drives

American Blower Type TM, traction-type fluid drives are also available as complete packaged units containing AC motor and built-in Gýrol Fluid Drive. Standard NEMA mounting bolt hole dimensions. 1 to 20 h.p.

Type VS, Class-2, adjustable-speed Gýrol Fluid Drive. Speed range: 5 to 1. Six sizes, 7½ to 800 hp; speeds to 1800 rpm.



Type VS, Class-6, Gýrol Fluid Drive. Adjustable-speed drive for compressors, pumps, and other high-speed applications. 200 to 12,000 hp; to 3600 rpm.

American Blower products serve the petroleum industry

- Air Conditioning, Heating, Ventilating Equipment
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- Centrifugal Compressors
- Gýrol Fluid Drives

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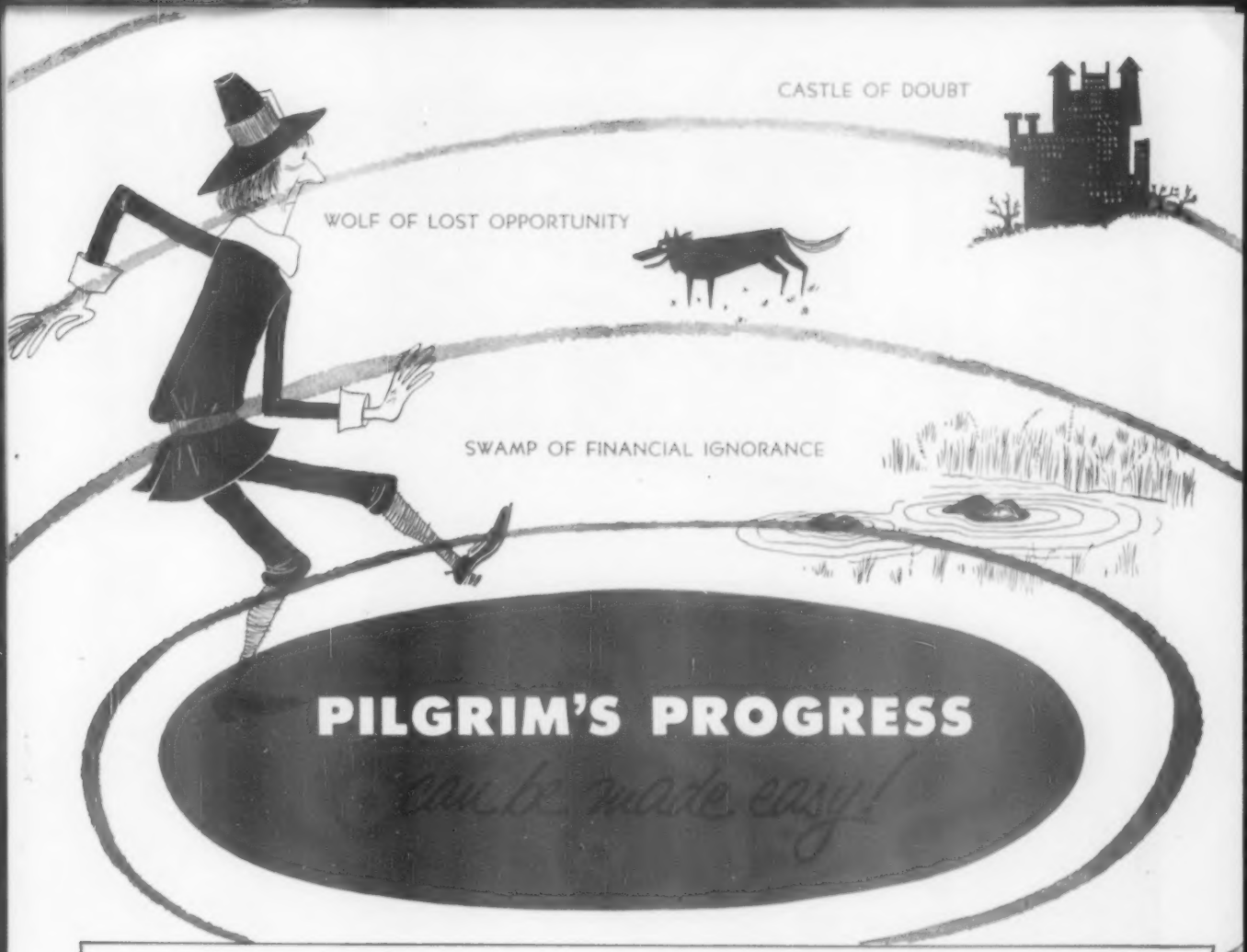

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The progress of your business depends on your ability to plan ahead — to plan for future, orderly growth. The proved experience of officers of The National Bank of Commerce can help you in making these plans. And they can help you to keep your business running smoothly. The National Bank of Commerce has every modern banking facility available for its industrial depositors. You can put these complete services to work for you when you make The National Bank of Commerce of Houston your bank.

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In a YEAR AND A HALF

Welex Formation Fracturing Tool has Boosted Production in More Than 500 Wells . . .

Read these typical case histories

THE TOOL THAT FIRES AROUND A CORNER

WEST TEXAS

A Spraberry Trend well was completed with bullets in two zones – upper Spraberry sand (6,663′ to 6,667′) and lower Spraberry sand (7,524′ to 7,540′) in September, 1952. Lower sand would not break down at 5,000 p.s.i. after another bullet perforating job and finally jet perforations. Well completed in upper zone, but by mid-1954, dropped to 63 barrels per day. Lower sand was perforated at 7,534′ with *one* shot of the Welex Formation Fracturing Tool, in September, 1954. Formation then broke down at 4,750 p.s.i. and was treated with a 4,500 sand frac job at 3,650 p.s.i. *Well flowed 295 barrels of oil per day and is holding that production.*

OKLAHOMA

A well was drilled in the S. W. Mt. Vernon Pool in Lincoln County in June, 1954, and was a dry hole. Bullet perforating (48 shots) was attempted with no results. Well was abandoned. Re-entered in August, cleaned out below casing, and squeezed off perforations. Well shot twice with Welex Formation Fracturing Tool at 3,385′ and 3,395′. Well was not treated. *After tubing was run, well flowed 32⅝ barrels in two hours and is now testing at 116 barrels per day.*

GULF COAST

A well in the Palo Blanco field had been perforated with no results. Five shots were fired from the Welex Formation Fracturing Tool between 4,745′ and 4,805′ before fracturing with 900 pounds of sand and 240 gallons of jelled oil. Prior to these shots and treatment, well tested 5 barrels per day. *It is now pumping 99.60 barrels per day.* In the same field, Welex shot two of a group of seven wells. Before using the Tool, the wells' averages were 55 and 63 barrels. *After the shots, each well is now making 145 barrels per day.*

Call on Welex . . . the developer of the Formation Fracturing Tool and jet perforating . . . before your next fracturing job. Their experience on more than 500 wells with this remarkable new tool will insure that your job will be better!

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- He's quality people... handling quality products.
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- He stocks exactly what you need, saving you time, paper work and storage space.
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A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

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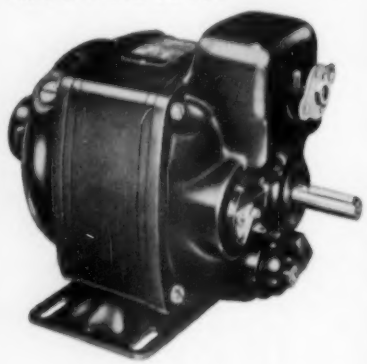
Leland offers you a complete line of explosion-proof motors from ¼ to 5 h.p., both standard and special

Choose an "extra-quality" LELAND MOTOR for every volatile pumping need

Leland standard horizontal explosion-proof motors, ¼ to 5 hp, ball bearing, externally fan cooled, Underwriters' Approved for Class 1, Group D

Standard gasoline pump dispensing motor, Type RA, repulsion start, induction run, Underwriters' Approved for Class 1, Group D



Whatever your gasoline or other volatile pumping requirements, you can depend upon a famous-for-*extra*-quality LELAND motor to serve you perfectly —now . . . and for a long time to come.

For *all* LELAND motors are built not merely to *meet*, but to *surpass* specifications—to give you the kind of performance that assures *complete* satisfaction.

This superiority is typified by LELAND *explosion-proof* motors. For ever since Leland introduced the first explosion-proof motor to meet Underwriters' requirements—over 30 years ago—LELAND gasoline dispensing pump motors have *outsold all others combined!*

You'll find this *same* superiority of design and construction in a complete line of standard horizontal units, a wide variety of vertical units, and a number of special variations for the pumping of both gasoline and liquid petroleum gas.

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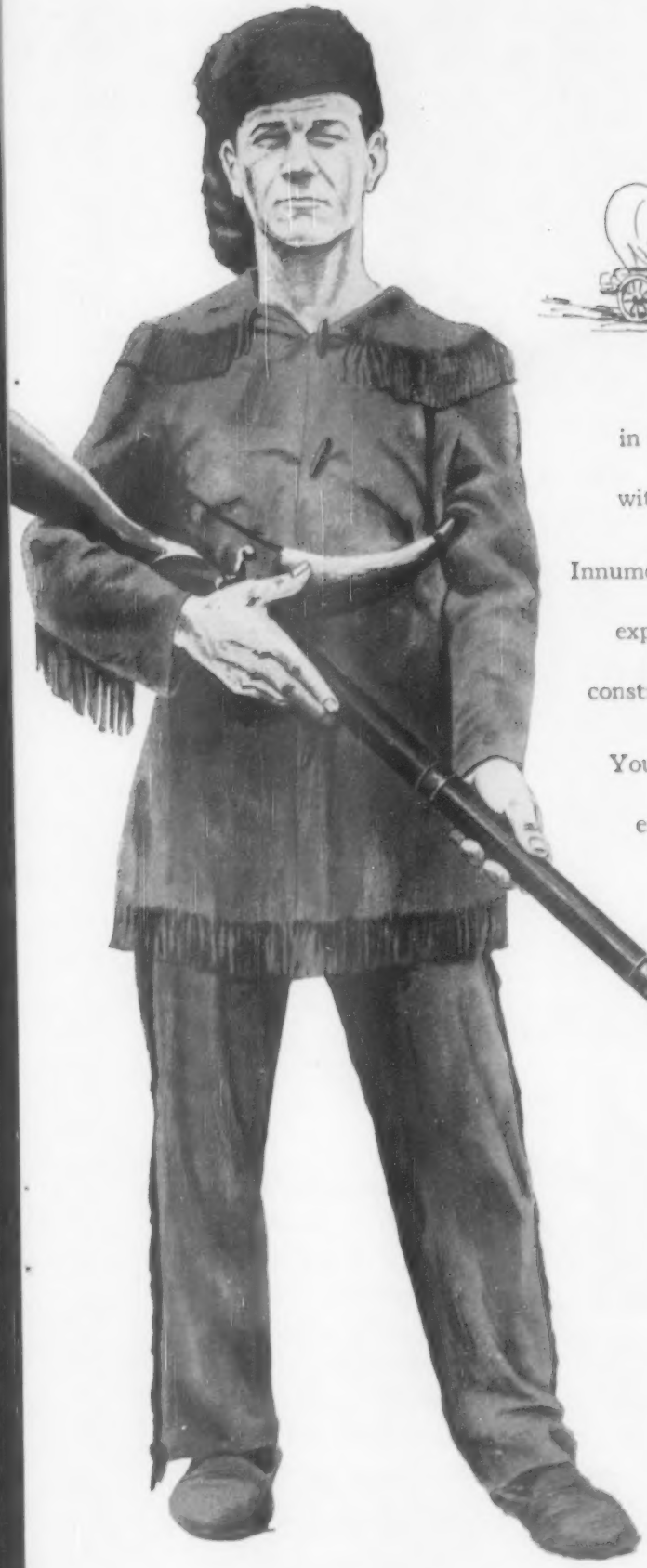
LELAND MOTORS

Look into the LELAND line. Contact your nearest authorized LELAND representative, or write THE LELAND ELECTRIC COMPANY, Division of American Machine & Foundry Company, Dayton 1, Ohio

Visit Leland at Booth 349, Production Engineering Show, Navy Pier, Chicago, September 6-16.



LEADING THE WAY

As they traveled through unfamiliar regions in their prairie schooners, the pioneer settlers of the western regions of America were faced with many uncertainties. For them, the journey was truly a voyage into the unknown.

Innumerable doubts and misgivings can be present, too, when you embark on an important expansion program, particularly when a decision must be reached on the selection of a process construction organization. There can be no turning back after the commitment becomes final.

You will be free of this concern when you choose Procon, with its complete design, engineering, and construction facilities. Procon has repeatedly demonstrated its leadership in completing a wide variety of projects according to the specified requirements.

Our engineering staff can show you in detail why your next process construction job should be handled by Procon.

PROCON *Incorporated*

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS
PROCON (CANADA) LIMITED—40 ADVANCE ROAD, TORONTO
PROCON (GREAT BRITAIN) LIMITED—112 STRAND, LONDON
WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

PROCON®

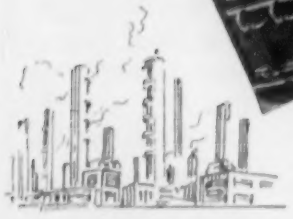
THIS 400,000 Pounds per HOUR

Vogt

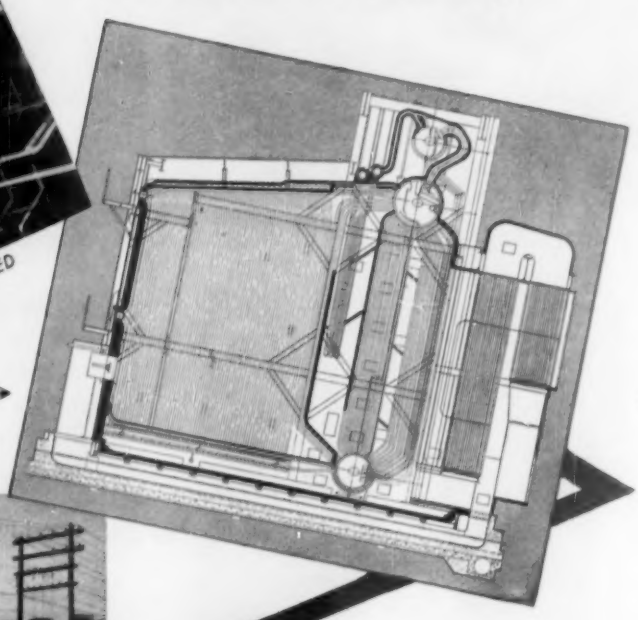
STEAM GENERATOR

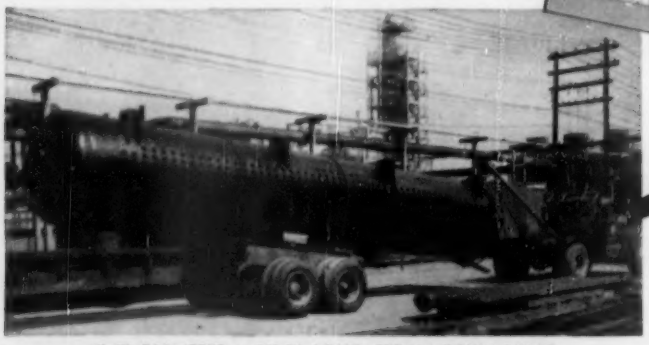
Gives Top Performance in a Leading Texas Petroleum Refinery

VIEW OF THE COMPLETED STEAM GENERATOR



RIGHT → LONGITUDINAL SECTION THROUGH THE UNIT.





6'-6" DIAMETER x 37'-0" LONG STEAM DRUM BEING TRANSPORTED TO THE ERECTION SITE DURING INSTALLATION.

PRINCIPAL DATA

400,000 pounds per hour capacity.

Fusion welded steam and water drums designed for 700 lbs. S.W.P.

Superheater delivers steam at 750°F. total temperature.

Water cooled furnace.

Burners for Oil and Acid Sludge fuel.

Vogt builds a complete line of bent tube steam generators designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Write for bulletins.

HENRY VOGT MACHINE CO., LOUISVILLE 10, KY.

BRANCH OFFICES: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

RUSH SERVICE IS STANDARD PRACTICE IN FILLING ORDERS FOR GASO PARTS

Here Is Why It Pays To

GET GENUINE GASO PARTS

Our reputation is built on pumps that continue to deliver top performance long after ordinary pumps have been scrapped.

What's back of this record? Design principles that call for fewer parts, made *extra strong.*

By their nature such principles call for extraordinary care in the design and construction of parts. *Every detail of every Gaso part is precision made to specifications developed through years of experiment and research.*

Only in genuine Gaso parts do you get the benefits of Gaso experience and standards. Why be satisfied with less?

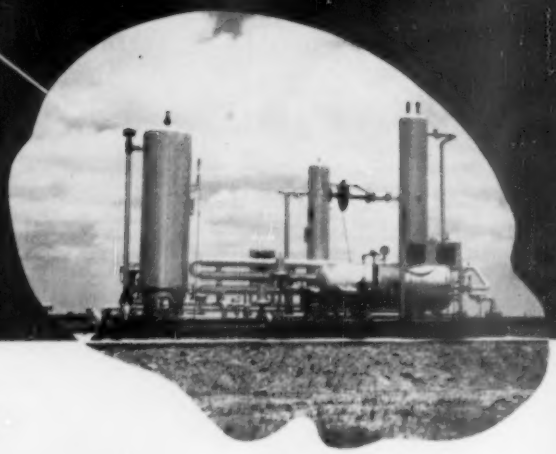
Gaso parts are easy to get. You will find stocks both at Tulsa headquarters and at each of the distributors listed below.

GASO PUMP & BURNER MFG. CO. TULSA, OKLAHOMA
EXPORT OFFICE 149 Broadway, New York

LUFKIN MACHINE CO., Ltd., Edmonton, Alberta
W. L. SOMNER COMPANY, Shreveport, Louisiana
New Orleans, Louisiana • Odessa, Texas
Tinsley, Mississippi • Brookhaven, Mississippi
POWER PUMPS, INC., Long Beach, California
PEDDLERS, INC., Houston, Texas
NORTEX ENGINE & EQUIPMENT CO., Wichita Falls, Texas
LUFKIN FOUNDRY & MACHINE CO., Casper, Wyoming

GASO PUMPS
for every oil industry need

Fingerprints or Gas Wells



no two are alike!

...that's why you need a custom-built PARKERSBURG *Hyreco Unit!*

The flow characteristics of gas wells are as different from each other (even in the same field) as the fingerprints of twins. These differences can be reconciled—without compromise—only by a Parkersburg custom-built Hyreco gas processing unit.

First, Parkersburg engineers—who are specialists in cold separation—correlate and analyze all the conditions present in your well. From this data they combine the standard elements of Hyreco cold separation units into the one assembly that delivers maximum efficiency.

Only the wide range of Hyrecos (capacities from 5 to 20 MMCF/D; pressures from 2000 to 6000 p.s.i.; available with single or twin tube vertical knockout for either liquid or water removal) provides the flexibility that makes this custom-building possible.

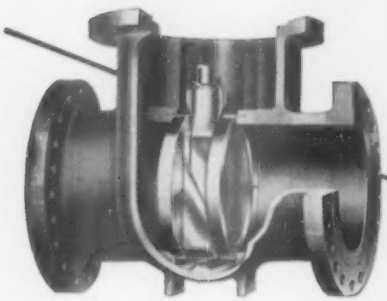
• *Ask your Parkersburg Representative for the full facts on the Hyreco Unit that is custom-built to your cold separation conditions.*

Parkersburg
RIG AND REEL COMPANY
DIVISION OF PARKERSBURG : AETNA CORPORATION

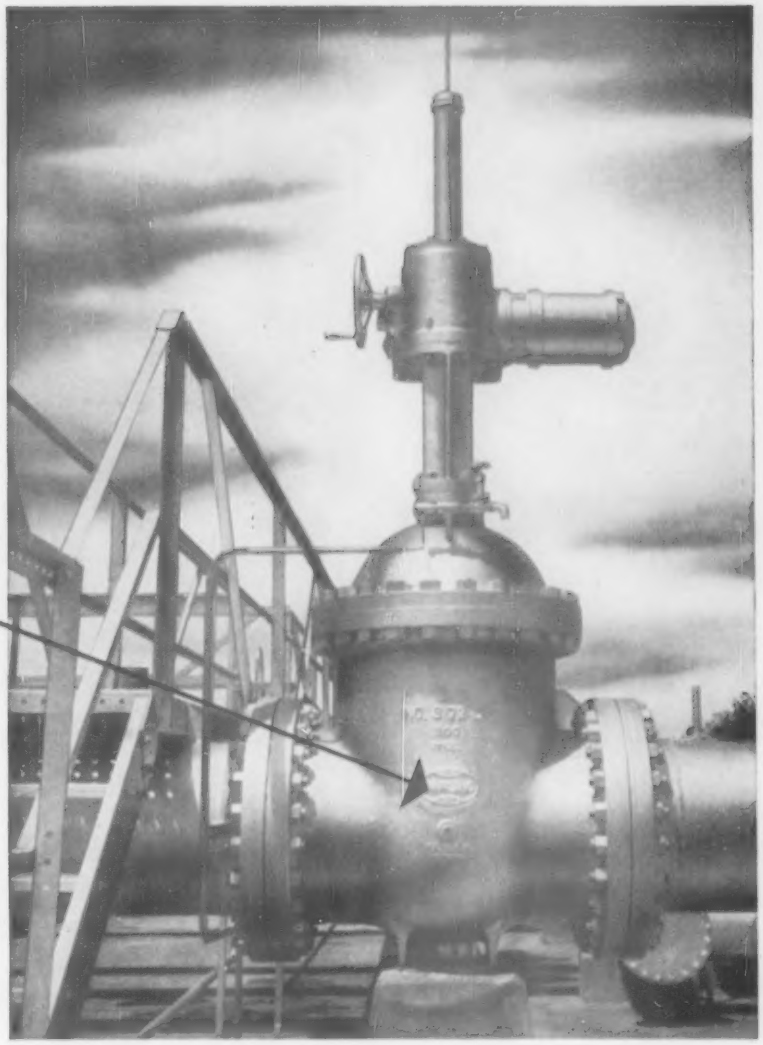
3345 WINTHROP AVENUE
FORT WORTH 16, TEXAS

5519

LOOK INSIDE



for dollars to be saved!



Darling 24", Series 300, motor-operated gate valve, with fully revolving double disc feature, at pipe line terminal of oil pumping station.

SURE! Other things being equal, it's definitely the inside of a gate valve that really tells the story. That's why we show and stress the importance to you of Darling's *fully revolving double disc, parallel seat principle!*

Simple construction, interchangeable no-pocket discs . . . yes . . . but that's only the start. This principle assures uniform distribution of disc-and-seat wear . . . coupled with Darling's unique wedging feature it once and for all licks the problem of faulty closure due to valve body distortion . . . and greatly eases operation even under the most adverse conditions.

That's why oil and gas men everywhere have come to count on Darling gate valves for surer performance, longer life and less down time. It pays. We'll gladly give you *all* the facts on Darling valves for your particular operations. Just ask.

DARLING

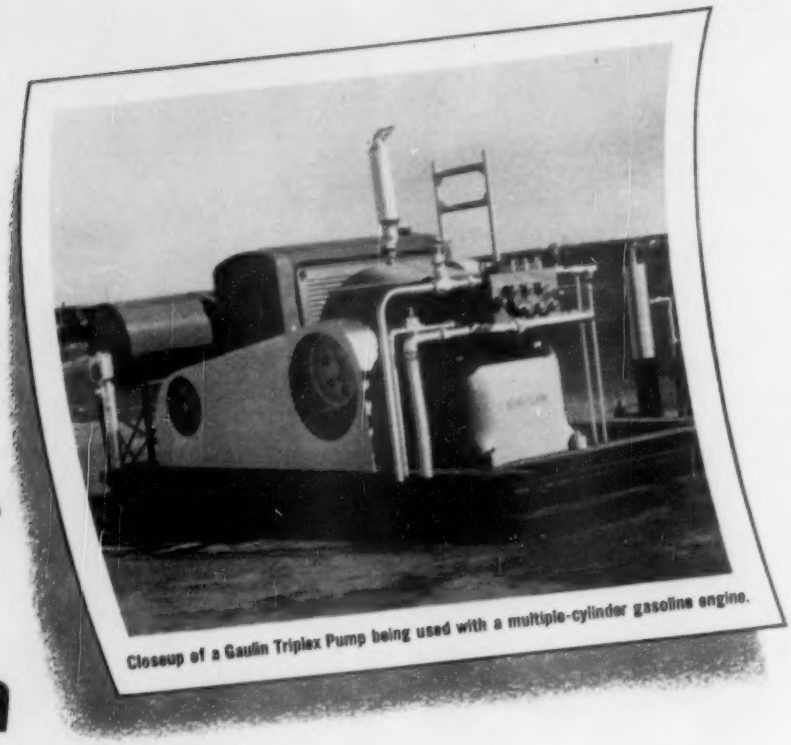
DARLING

VALVES

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.



Closeup of a Gaulin Triplex Pump being used with a multiple-cylinder gasoline engine.

Month after Month, You know a GAULIN TRIPLEX PUMP

Surface Power Unit for Subsurface Hydraulic Pumping will keep on producing . . .

Write today — at no obligation — for your copy of the booklet that describes all of these Gaulin features:

Horizontal Design of power unit completely separates cylinder from crankcase, preventing any product leakage to crankcase. Cylinder assembly may be taken apart in minutes. Just lift cover and all parts instantly accessible for inspection or repair.

Plexiglas Well Covers give instant visual check of plunger and packing condition.

Corrosion-Proof Cylinder is made of stainless. Hardened stainless or ceramic plungers available.

Spring-Loaded Plunger packing is self-adjusting, self-sealing, eliminates the human element.

API Ball Valves and removable seats permit easy replacement in the field.

Wide Capacity and Pressure range easily, economically obtained by changing plunger size in the field.

CALL: **SPECIALTY SALES & SERVICE, INC.**

TULSA, OKLAHOMA—(TULSA LUther 4-2226) ODESSA, TEXAS—(ODESSA 6-0921)

MANTON-GAULIN MANUFACTURING CO., INC.

LA HABRA, CALIFORNIA

M. LES WALRAVEN, MGR. OIL FIELD SALES (OXFORD 7-6334) (LONG BEACH 4-1596)

MANUFACTURED BY

MANTON-GAULIN

MANUFACTURING CO., INC.

73 GARDEN ST., EVERETT, MASSACHUSETTS

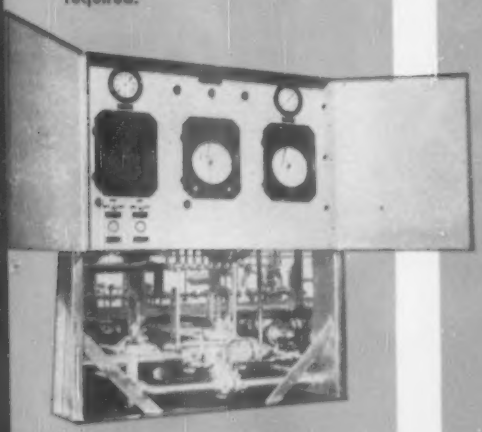
Gaulin

For Drying Natural Gas...

...To Pipeline Specifications At Peak Efficiency Under A Wide Range Of Stream Flow Conditions, Specify The BS&B Custom-Sized Dry Dehydrator!

Specifically engineered for use along natural gas pipelines, and by large-volume gas producers who must deliver pipeline specification gas to the sales line, the BS&B Model DDH Dry Type Dehydrator utilizes the desiccant at its highest performance level over a wide range of gas stream flow conditions. Even gas at high inlet temperatures or low inlet pressures is handled without difficulty by this unit.

Automatic cycling with 3-way switching valves is a recognized feature of the BS&B Dehydrator. A time cycle controller synchronizes the switching sequence of the valves to prevent back flow, mixing of dehydrated and wet gas and pressure or shock surges which break down the desiccant. BS&B 3-way valves also simplify the piping and make a more compactly designed unit possible by reducing the number of valves required.



Here are some of the unit's outstanding features:

- Exclusive BS&B compartmented dual horizontal sorbers make possible a more compact design, with reduced unit cost and installation time.
- Transverse gas flow through sorbers results in greater efficiency and longer desiccant life.
- All instruments for the completely automatic continuous operation of the unit are housed in a weatherproof cabinet.
- No outside power sources are required.
- Unit includes famous BS&B Salt Bath Heater for proper regeneration gas temperatures at maximum safety.
- BS&B three-way valves, used in cycling the sorbers, reduce the piping required and make possible a more compact unit.
- Convenient platform between sorbers provides an easy method for loading or replacing desiccant.
- Units can be "custom-sized" to meet your requirements.

For More Information On The BS&B Model DDH Dehydrator, Contact Your Nearest BS&B Representative, or write to...

BLACK, SIVALLS & BRYSON, INC.

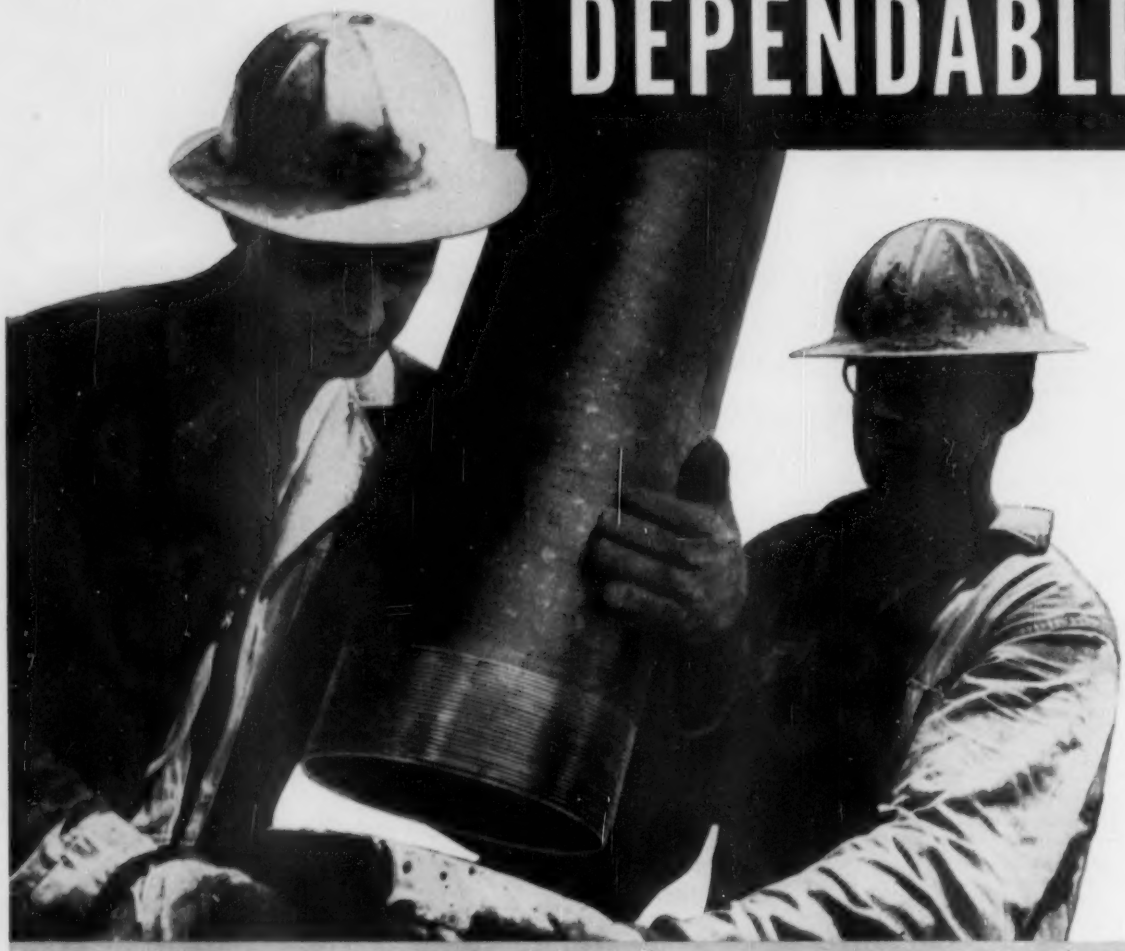
Oil & Gas Equipment Division, Dept. 1-A8

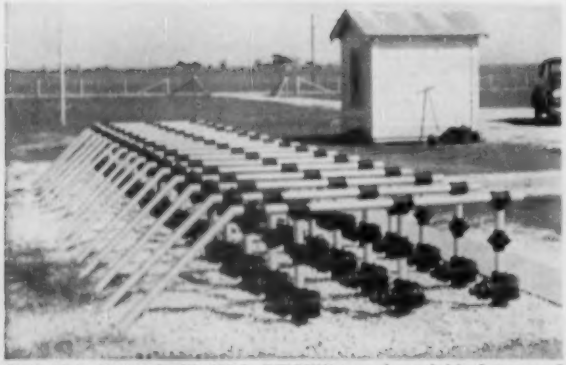
1708 West Main Street — Oklahoma City, Oklahoma

EFFICIENCY · OVER 60 YEARS · BS&B · RELIABILITY

ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

DEPENDABLE





EASE OF THREADING, BENDING, WELDING are dependable features of Republic's Continuous Butt Weld Pipe. A standard in the oil and gas industry for years, this pipe is used for gathering lines, distribution lines and general maintenance work. Other features: uniform strength and ductility; tight adherence of the galvanized coating. Sizes ⅛″ through 4″ nominal. Available in economical double-random lengths. Call your Republic Distributor.

FAST, DEPENDABLE WELDS ARE EASY when you use Republic Electric Weld Line Pipe. Constant circumference assures quick, easy alignment. Uniform wall thickness prevents thin spots, provides a good base for strong, smooth beads. High ductility results in uniform bends in field or shop. Republic makes 2 types of electric weld: Electric Resistance Weld (2⅜″ through 16″ O.D.), Electric Fusion Weld (24″ through 30″ O.D.).

..right down to the last thread

It's a good one-word description of Republic Electric Weld Casing *quality.* And it's important to know that no matter how shallow or deep the well, you can count on *uniform dependability* throughout every joint in your string.

All Republic Electric Weld Casing is produced with precisely the same care. Skelp of uniform thickness is carefully trimmed to correct width, cold-formed and welded into a tube of uniform roundness. The highly ductile steel is fully normalized to assure uniform grain structure—then cold-sized to obtain a high-yield strength.

It's the uniform roundness and high-yield strength that provide such a strong resistance to collapse. But no less dependable is the Electric Resistance Weld. In fact, tests have proved *the weld to be as strong or stronger than the wall itself!*

Since no string is stronger than its weakest thread, Republic makes certain steel thickness under thread roots is uniform. And the clean, full-formed threads make it easy to stab, spin in and tong up quickly.

Republic Normalized Electric Weld Casing and Tubing, famous throughout the oil industry for more than 25 years, are available in grades H-40 and J-55, in sizes ranging from 2⅛" through 13⅜" O.D.

Republic makes seamless, too. Produced in the world's most modern seamless mill, Republic Seamless Casing and Tubing are made by skilled craftsmen and the very latest in precision equipment. It comes in grades J-55 and N-80, sizes 2⅜" through 9⅝" O.D. Contact your Republic Distributor for complete details. *Send coupon for literature.*

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

TOUGH THREADS AND HIGH TENSILE STRENGTH assure dependable protection for your high-pressure equipment when you use Republic Alloy Steel Studs. Threads tighten smoothly, provide maximum holding power, resist wear. And studs back off easily for equipment maintenance. Specify Republic Alloy Steel Studs on your orders for new valves, headers, pressure vessels. Keep a supply in stock for replacement. Your Republic Distributor has them.

REPUBLIC STEEL

REPUBLIC STEEL CORPORATION
3112 East 45th Street
Cleveland 27, Ohio

Please send me more information on:

☐ Casing and Tubing
☐ Alloy Steel Studs

Line Pipe—
☐ Electric Resistance Weld
☐ Electric Fusion Weld
☐ Continuous Butt Weld

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

A PUMP PACKING THAT'S EXPENSIVE, BUT CHEAP!

Heavy Teflon† impregnation throughout
Choice of Canadian white asbestos or blue African asbestos
Unique LATTICE BRAID* construction plus Teflon core

Lasts at least 3 times longer than ordinary pump packings

Frankly, the service reports on LATTICE BRAID asbestos packing with Teflon surprised us! Originally designed and test-proven for use against severe acids, caustics, and other chemicals, this particular packing has out-performed other packings (*even our own*) on more common applications against water, steam, solvents, and oils.

And here's why: (1) The LATTICE BRAID construction gives greater strength; (2) The Teflon core and heavy Teflon impregnation resist everything except molten alkali metals and some freons; (3) It does not adhere to the shaft or rod; (4) It runs smoother and freer than packings without Teflon.

Check these typical service reports:

- Against blending waxes and steam (for cleaning), it outlasted another Garlock style 10 to 1
- Against caustic at 325°F., 50 p.s.i., it outlasted competitive packing 38 to 1
- Against cold water, it out-performed other packings 3 to 1

LATTICE BRAID with Teflon is available in either Canadian white asbestos (style 5861) or blue African asbestos (style 5880). Each is furnished in packing sizes $\frac{5}{16}$" to $1\frac{1}{2}$" graduated by sixteenths.

Try an order of 10 feet or more today. Chances are you can *reduce* down-time, maintenance and replacement costs to *one-third* of their present amount.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Sales Offices and Warehouses: Baltimore • Birmingham • Boston • Buffalo Chicago • Cincinnati • Cleveland • Denver • Detroit • Houston Los Angeles • New Orleans • New York City • Palmyra (N.Y.) Philadelphia • Pittsburgh • Portland (Oregon) • Salt Lake City • San Francisco • St. Louis • Seattle • Spokane • Tulsa.
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

*Registered Trademark †The Du Pont Company's Trademark

GARLOCK LATTICE BRAID with TEFLON

They Say—

What Guatemala Offers

Dear Sir:

On behalf of the Government of Guatemala I am enclosing herewith some photographs that we hope will be of interest to your well-known publication . . .

The law was published July 19, 1955, and will be effective 30 days after date of its publication. Regulations will be issued within 60 days thereafter, and an additional period of 30 days has been provided within which original applications are given equal priority. Subsequent thereto priority is given to all applications according to date of filing.

Applicants my obtain as much as 1,000,000 acres in exploration rights and 500,000 acres for exploitation rights. Exploration term is 6 years, with two possible extensions of 2 years each when obligations established therein have been duly complied. Exploitation term is 40 years with a possible extension of 20 more years.

There is a definite 50 per cent tax limitation which includes royalties of ⅛, rentals, direct taxes, and other taxes on profitable enterprises.

This office is willing to cooperate with you in supplying any information with regard to the Guatemalan oil law you may desire.

Carlos Cifuentes Diaz
Secretaria de Divulgacion
Cultura y Turismo
Guatemala City, Guatemala

Editor's Note: For more on Guatemala and the new law, see the Journal's article on page 76 in the August 1 issue.

How Trade Journals Serve You

"Trade and business publications are such a normal part of our commercial life that rarely does one give thought to their technical-economic significance. Yet, they, like the scientific journals, are key cogs in our machinery for progress — mechanisms we could not do without.

"The chief function of the trade or business journal is . . . to inform . . . The advertising columns that support these publications—important also as sources of information—are the showcases of the products and services of interest to businessmen . . .

"But trade and business publications do even more. They fill the gap in communications between the laboratory scientist and practical operating and management personnel. Edited as they

are for those who put the results of research to work, they are important chroniclers of technology to productive people. They take over where the scientific journals leave off and interpret scientific advance to the people capable of and interested in applying it. Thus, they constitute a link between the laboratory and the shop through which industrial progress is transmitted.

"The research scientist who reads the trade and business journals in his field keeps his feet on the ground and his aspirations realistic . . .

"To the chroniclers of technology, we thus owe much for the dynamicism of our present industrial economy."

Clyde Williams, president and director, Battelle Memorial Institute.

Interested in Industrial "Reodorants"

Dear Sir:

We learned from your Journal of the 6th of June, page 84, that Mr. C. H. Nichols, Rhodia, Inc., New York, gave a detailed statement about industrial improvers of smells during the course of a conference of the Western Refiners Association at Big Spring, Tex.

We would like to get more details about these improvers for the production of petroleum and . . . would be obliged to you if you could let us have the exact address of Mr. Nichols or if you could inform Mr. Nichols that we are very much interested in obtaining a product which can be applied as an improver of smell . . .

Johann Haltermann
Mineralol-Destillation
Ferdinandstrasse 55-57
Schiffahrtshaus
Hamburg, Germany.

Editor's Note: C. H. Nichols can be reached at Rhodia, Inc., 230 Park Avenue, New York 17, New York.

The Lion-Monsanto Merger

"Lion has a well-balanced and integrated oil producing, refining, and distributing organization with a record of achievement and good management. Its exploration department has been successful in recent years in adding to its oil and gas reserves.

"Other than fuel and power, more than one-half of Monsanto's raw materials are products which can be or are produced from petroleum fractions or natural gas. It is the belief of both organizations that this union will hasten a long-range program of producing an increasing variety of chemical raw materials."

Charles Allen Thomas, president, Monsanto Chemical Co., in a statement made following the announcement that Monsanto and Lion Oil Co. would merge.

New ...a powerful
weed
and grass
killer
prevents regrowth!
UREABOR*
*TRADEMARK OF BORAX CONSOLIDATED, LIMITED
You get Full Season's Control from One Application!
Precaution against fire begins with weed elimination! Treat any area lightly with dry, ready-to-use UREABOR and you'll clear the ground of growth for a year, or more! It's that simple! No special equipment nor spray rig necessary. Save on labor and cut your maintenance costs the easy way—with UREABOR Weed Killer.
APPLY IT DRY
No fuss...no muss
...Just a man
and a pail
Use UREABOR to destroy vegetation about fence lines, well sites, pipe lines, refinery buildings, heater units, tank batteries, and all places where ground must be kept bare.
Write for literature today!
NOTHING TO MIX
NO WATER TO HAUL
NONPOISONOUS
When applied as directed
NONCORROSIVE
To ferrous metals
AGRICULTURAL SALES DIVISION
PACIFIC COAST BORAX CO.
DIVISION OF BORAX CONSOLIDATED, LIMITED
630 SHATTO PLACE • LOS ANGELES 5, CALIFORNIA
MANUFACTURERS OF FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS

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Bradford, Pa.
Seamless Welding Fittings.

OIL STATES EQUIPMENT COMPANY
Houston, Texas
OSECO Silvertop Fusible Plugs with renewable inserts for all types OIL COUNTRY BOILERS.

THE GORMAN-RUPP COMPANY
Mansfield, Ohio
Centrifugal Pumps.

STEEL FORGINGS, INC.
Shreveport, La.
Weld Saddles.

HARRISBURG STEEL CORPORATION
Harrisburg, Pennsylvania
Forged Steel Flanges and Seamless Casing Couplings.

VOLCANO BURNER COMPANY
Houston, Texas
Volcano Superior and Gulf States All Steel Gas Burners for OIL COUNTRY BOILERS.

LOS ANGELES BOILER WORKS
Los Angeles, California
Welding Caps—Dished & Flanged Heads.

WESTERN SAFETY BARREL STAND
Houston, Texas
Stand lifts, holds, tilts 55 gal. barrels Prevents spillage—easily loaded.

MILLS IRON WORKS, INC.
Los Angeles, Calif.
Seamless Swage Nipples, Bull Plugs & Welding Reducers.

WHEELING MACHINE PRODUCTS CO.
Wheeling, West Virginia
XL Steel Pipe Couplings for OIL COUNTRY TUBULAR PRODUCTS.

CALENDAR

AUGUST

15-16 North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.

15-17 Society of Automotive Engineers, golden anniversary West Coast meeting, Hotel Multnomah, Portland, Ore.

19 Southern Gas Association, transmission section round table on pipeline engineering, natural-gas gathering and processing, and pipeline operations and maintenance, Hotel Adolphus, Dallas.

29-31 15th annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

26-Sept. 15 Graduate summer session in reservoir engineering, University of Texas, Austin.

SEPTEMBER

2-3 Association of Desk and Derrick Clubs of North America, fourth annual convention, Commodore Hotel, New York City.

11-13 Independent Natural Gas Association of America, annual meeting, Jasper Park Lodge, Jasper Park, Jasper, Alberta, Canada.

12-14 American Institute of Electrical Engineers, electrical conference of the petroleum industry, Shamrock Hotel, Houston.

12-16 Tenth National Instrument Conference and Exhibit, Los Angeles, Calif.

12-16 Second International Instrument Congress and Exposition and tenth National Instrument Conference and Exhibit, Shrine Auditorium, Los Angeles.

14 American Association of Petroleum Geologists Western Canada regional meeting, and Alberta Society of Petroleum Geologists 5th annual field conference, Jasper Park Lodge, Jasper National Park, Alberta.

14-16 National Petroleum Association, 53rd annual meeting, Traymore Hotel, Atlantic City, N. J.

14-17 American Association of Petroleum Geologists, western Canada regional meeting and fifth annual field conference of Alberta Society of Petroleum Geologists, Jasper, Alberta, Canada.

22-23 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

22-23 Louisiana - Arkansas Division, Mid-Continent Oil and Gas Association, annual membership meeting, Roosevelt Hotel, New Orleans.

25-28 American Society of Mechanical Engineers, Petroleum Mechanical Engineering Conference, Roosevelt Hotel, New Orleans.

26-28 American Association of Oilwell Drilling Contractors, fifteenth annual meeting, Rice Hotel, Houston.

26-28 American Institute of Chemical Engineers, fall national meeting, Lake Placid Club, Lake Placid, N. Y.

29 Natural Gasoline Association of America, Oklahoma regional meeting, Skirvin Hotel, Oklahoma City.

OCTOBER

2-5 American Institute of Mining and Metallurgical Engineers, Petroleum Branch, fall meeting, Roosevelt Hotel, New Orleans.

2-6 American Society for Testing Materials, Committee D-2, petroleum products and lubricants, Statler Hotel, Washington, D. C.

Meet your **production**

EQUIPMENT SPECIALISTS

in **Wyoming** *and the* **Williston Basin**

When you need equipment for your next well, call your Union Tank sales and service man. DAY OR NIGHT, his years of experience are available to help you solve the production equipment problems on your leases. This service, combined with dependable Union Tank production equipment means a more profitable operation to you. That's why it will pay you to know the following men:

G. W. Williams
District Manager
Casper, Wyoming

J. E. Wren
Casper, Wyoming

W. H. Clayton
Branch Manager
Powell, Wyoming

L. L. "Buddy" French
Branch Manager
Williston, North Dakota

When your next well comes in, call Union Tank for fast, skillful service with dependable follow up on . . .

Welded steel tanks
Bolted steel tanks
Wood tanks
Stairways, walkways
Texsteam pumps
Vertical separators
Horizontal separators
Indirect heaters
Emulsion heaters
Heater tanks
Heater-treaters
Cold sep. & dehyd. units
Valves and regulators
Loading racks

UNION TANK AND SUPPLY COMPANY

P. O. Box 2092, Houston, Texas

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3-4	Texas Mid-Continent Oil and Gas Association, 36th annual meeting, Baker Hotel, Dallas.
3-6	Society of Exploration Geophysicists, 25th annual meeting, Shirley Savoy Hotel, Denver.
3-6	Rocky Mountain Association of Petroleum Geologists and Denver Geophysical Society, 25th annual meeting, Denver.
9-15	American Petroleum Institute, Oil Progress Week.
12-14	Gulf Coast Association of Geological Societies, annual meeting, Buena Vista Hotel, Biloxi, Miss.
12-14	Gas Appliance Manufacturers Association, El Mirador, Palm Springs, Calif.
12-14	National Association of Corrosion Engineers, sixth biennial Permian basin tour, Lincoln Hotel, Odessa, Tex.
13-14	California Natural Gasoline Association, annual fall meeting, Ambassador Hotel, Los Angeles.
14	American Institute of Chemical Engineers, South Texas Section, 10th annual technical meeting, Galvez Hotel, Galveston, Tex.
14-15	National Society of Professional Engineers fall meeting, Peabody Hotel, Memphis, Tenn.
17-19	American Gas Association and Pacific Coast Gas Association, annual meeting, Ambassador, Biltmore, and Statler Hotels, Los Angeles.
18-22	National Safety Council, 43rd National Safety Congress and Exposition, Chicago.
20-21	Western Petroleum Refiners Association, regional technical-industrial relations meeting, Garrett Hotel, El Dorado, Ark.
24-27	National Association of Railroad and Utilities Commissioners, natural gas panel discussion, Asheville, N. C.
27-29	Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.
28	Natural Gasoline Association of America, southern regional meeting, Captain Shreve Hotel, Shreveport.
31-Nov. 1	Independent Petroleum Association of America, annual meeting, Jefferson Hotel, St. Louis.
31-Nov. 2	National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago.

NOVEMBER

2-4	Society of Automotive Engineers, diesel engine meeting, Chase Hotel, St. Louis.
2-4	American Association of Petroleum Geologists, Mid-Continent regional meeting, Skirvin Tower, Oklahoma City.
9-10	Society of Automotive Engineers, fuels and lubricants meeting, Bellevue-Stratford Hotel, Philadelphia.
10-11	American Association of Petroleum Geologists, Pacific Section annual convention, Biltmore Hotel, Los Angeles.
11-13	New Mexico Geological Society, in conjunction with Roswell Geological Society, sixth annual field conference, Truth or Consequences, N. M.
13-18	American Society of Mechanical Engineers, 75th anniversary meeting, Hilton and Blackstone Hotels, Chicago.
14-17	American Petroleum Institute, 35th annual meeting, Mark Hopkins, Fairmont, St. Francis and Palace Hotels, San Francisco.
27-30	American Institute of Chemical Engineers, annual meeting, Statler Hotel, Detroit.

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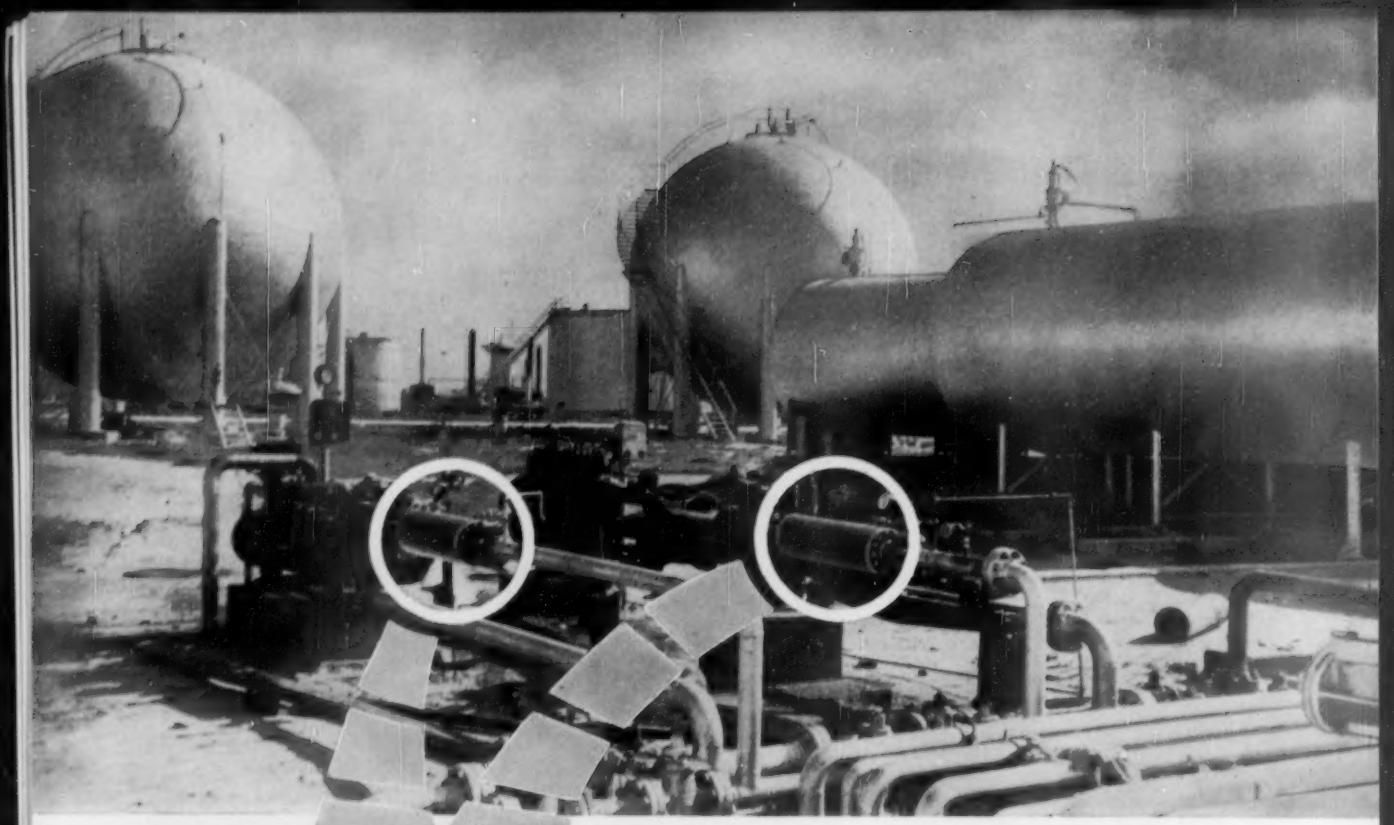

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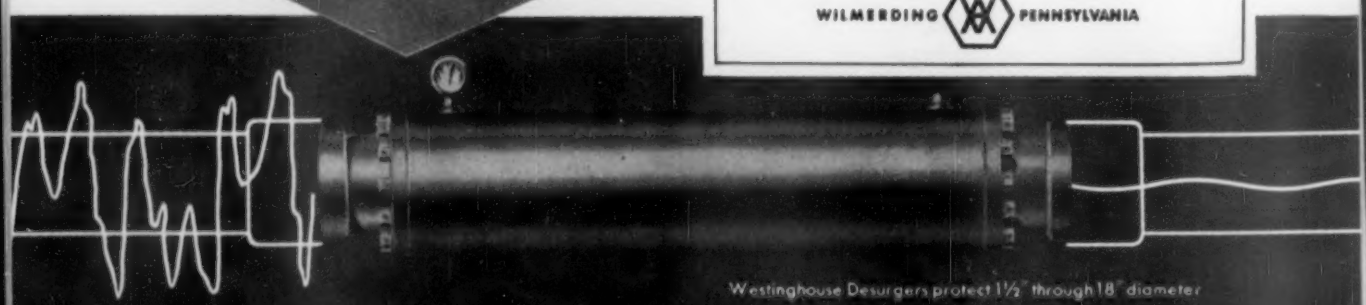

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

The Marvelous Turbodrill

ANOTHER myth of Soviet superiority has just been shattered for us—the myth of the marvelous, mysterious Russian turbodrill.

In Washington during the war a colonel in Army Intelligence told us, in strictest confidence, about this miraculous instrument. According to his version it was a self-contained unit, operating without a drill stem, and powered and controlled by an electric cable from the surface. It was developed for oil-well drilling but was being adapted to civil-engineering projects, such as tunnels and water conduits, and had some very hush-hush military possibilities.

This drill (he said) could cut through the hardest sort of rock in practically no time at all, and its instrumentation and control were so perfect that it could be made to follow any desired course—down, sideways, or cattawampus. For example, it could bore straight down a ways, then turn horizontally, and finally come up to the surface under the enemy's lines.

We asked our informant what the drill pushed against and how the cuttings were got out of the hole. His answers were a bit vague and indicated a little irritation, so we didn't press the point. (Washington correspondents were thoroughly indoctrinated against asking too many nosy questions about technical details on top-drawer military secrets like this one.)

Now comes the denouement.

We have just come across a pamphlet published (in both Russian and English) by the U.S.S.R. Academy of Sciences describing turbine drilling in the Soviet Union.

It turns out to be not so much.

Now don't get us wrong. We'll give the Russians credit for ingenuity and engineering ability. Our political leaders are telling us not to make the mistake of underestimating the Russians. This turbodrill appears to be a pretty darned good tool. But it's not at all magical, and it's not at all the way that intelligence officer described it.

The Russian turbodrill uses a conventional three-cone rock bit, conventional drill pipe, and conventional drilling mud. Only there's no rotary table. The drill pipe doesn't turn. On the bottom of the drill stem is a hydraulic turbine which is turned by mud or water pumped down the drill pipe. The turbine rotates the bit, which is geared up to turn at 5 to 10 times the speed of normal rotary drilling. The Russian engineers had to redesign the bit teeth to stand such high speeds.

The turbodrill won't do anything the American rotary won't do, but, the pamphlet says, it will do it faster except in soft formations and shallow holes. The Russians now use it for about two-thirds of their drilling. Side-by-side with a rotary, they say, it will drill faster and the bits last longer in the same formation, and the harder the rock and the deeper the well, the greater its advantages over a rotary.

A recent wrinkle is a three-stage tandem turbine, which requires less pressure from the mud pump at great depths. They have a triple-header that will take a 5⅝-in. bit, and are working on a 4-in. model for slim holes.

Directional drilling is a breeze with the turbodrill, it is implied, because it whipstocks and holds direction better than a rotary. So it is used to make nearly horizontal drain holes in the pay formation. It drills so fast that the biggest time problem now is round trips to change bits. So the Soviet drillers often drill two holes at once, slanted to bottom on the proper spacing. When a joint of drill pipe comes out of Hole No. 1 it is put down into hole No. 2 without stacking. When the No. 2 bit is on bottom the crown block is shifted over its center and it is drilled until the bit needs changing, and then the process is reversed.

But if you think that's a neat trick, take a look at what those Russians are trying now—a way of changing bits without taking the drill pipe out of the hole. They're experimenting with a two-cone bit that will slide down inside the drill pipe sideways, then turn and seat for drilling, and can be disconnected and brought to the surface by wire line.

Clever, eh? But still a long way from that pipeless, mudless, derrickless marvel we heard about as a deep wartime secret.

—*Henry D. Ralph*

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Heavy fuel oil is looking up

THERE is an interesting trend in residual fuel oil which holds significance to both producers and refiners. Markets for residual seem to be increasing faster than its production. The potentialities indicate that this trend will be accentuated in the future. This trend is world wide.

In recent months the market for resid has been firm and strong in most parts of the United States. California has worked off its burdensome inventories. The East Coast price has been increased. Stocks have dropped to a low level.

These are but indications of a long-range trend. Domestic demand has increased very little since the war but should improve if industrial sales of natural gas taper off as expected. But domestic supply is on the downgrade.

OUTPUT OF RESID IN THIS COUNTRY has declined 5 per cent since the end of the war while refinery throughput was increasing 45 per cent. Ten years ago nearly 28 per cent of a barrel of crude came out as resid; today the yield is barely over 16 per cent. Refiners have gone in heavily for coking and other processes to make as little resid as possible. Since this is the only important refined product which sells for less than the price of crude, the trend is certain to continue.

In Europe the demand for resid is strong and growing steadily, due both to high industrial activity and to a shift from coal. Again, this trend looks like a continuing thing. An indicator: British utilities have just placed large, long-term contracts for imported fuel oil.

WHAT ALL THIS MEANS is that resid may never again be much of a drug on the market. Competition from other fuels will keep its price from rising to a point where refiners as a whole would rather make it than something else, so supply won't increase unduly.

But demand, world wide, will continue strong, steady, and expanding, thus readily absorbing what resid may be made unavoidably or conveniently.

To United States refiners this promises a somewhat better price for resid. This may slow down the recent push to reduce residual yields, but certainly won't halt it, because other products will still offer better profit margins to most refineries.

To domestic producers it promises a somewhat better market for low-gravity crudes. It forecasts an increase in residual imports but a lessening impact of these imports on domestic production—truly supplementing rather than supplanting domestic supplies.

For the world as a whole this trend suggests that there will be little heavy oil pressing to enter the United States because equally good or better markets will exist in Europe and elsewhere.

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THIS WEEK . . . . . IN THE NEWS

Exploration

• Glasscock Drilling was making hole last week in water deeper than any yet drilled off Texas. The wildcat, being drilled for Tide Water and Atlantic, is in 83-ft. water 20 miles east of Port Aransas.

• Phillips Petroleum last week was rigging up 40 miles out in the gulf off Louisiana, farther seaward than any well yet drilled offshore. Despite the great distance from land, the rig is in only 85 ft. of water.

• Union's wildcat in southern Beaver County in Oklahoma's Panhandle flows 4,400 M.c.f. of gas on potential test. Well earlier recorded an open-flow rate of 150,000 M.c.f. daily.

Secondary Recovery

• The last of the older big fields of Illinois boom days is succumbing to water flooding. Ultramodern surface facilities are being constructed for the 1,930-acre flood, which engineers hope will recover an additional 2,000,000 bbl. of oil. The unit includes 13 operators and nearly 240 royalty owners on 49 separate tracts. Shell Oil Co. is unit operator.

• Officials of SACROC Unit are well pleased with water-flooding operations in Texas' Kelly-Snyder field to date. The huge unit, covering almost 50,000 acres, plans to start water flooding in the north end, where it has been injecting gas.

International

• Libya is proving attractive for international oil companies seeking concessions in wake of the North African country's new oil law. A dozen firms have filed bids, most for acreage in Tripolitania and northern Cyrenaica. Many are seeking the same area. This means a big arbitration task ahead for the Libyan petroleum commission.

• Stockholders of Glenn McCarthy, Inc., have approved sale of half the firm's Bolivian concession for $2 million to finance developing the property. The syndicate putting up funds got the half interest for $2,160,000 less than the price first negotiated.

• Colombia is the latest South American nation to ease rigid price controls on products sold for internal consumption. Easing of controls on petroleum products came after Shell entered the country as a strong marketer giving competition to Esso Colombiana, S. A.

• International refinery expansion is still on the upgrade. Standard-Vacuum Oil Co. soon will start a $20 million modernization program at its large plant near Palembang, Sumatra. Work has been completed on new processing units at Petroleos Mexicanos' refinery near Mexico City.

Pipeline

• FPC agrees to hear Lone Star Gas Co.'s request to build a 220-mile natural-gas line in Oklahoma and Texas. Both Lone Star and Natural Gas Pipeline Co. of America have plans to move gas from Jack and Wise counties in Texas to Fritch, Tex. Lone Star says Natural Gas will pay 15 cents a thousand, more than Lone Star is now paying in the area. Lone Star says Natural's plan would cost the Lone Star firm $13,000,000 annually in higher prices for its gas. Lone Star is offering to build the lines to supply Natural Gas at Fritch.

Research

• Socony Mobil is joining with seven other American firms to build and operate the first nuclear reactor owned and used by private industry for research. It will be located somewhere in the New York area. Socony Mobil also is going to construct its own nuclear research center. It's part of a large-scale program to investigate new energy sources and improvement of oil refining and products.

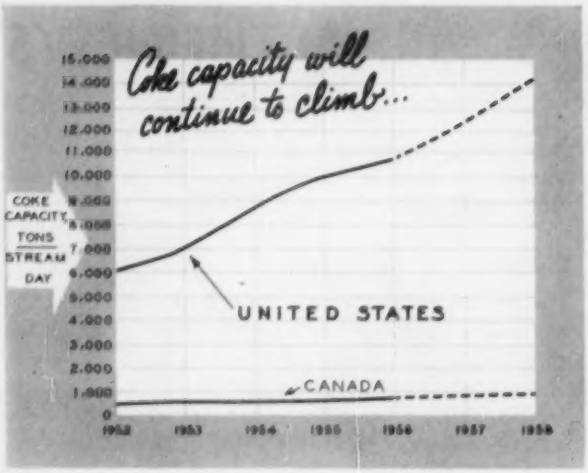
Production

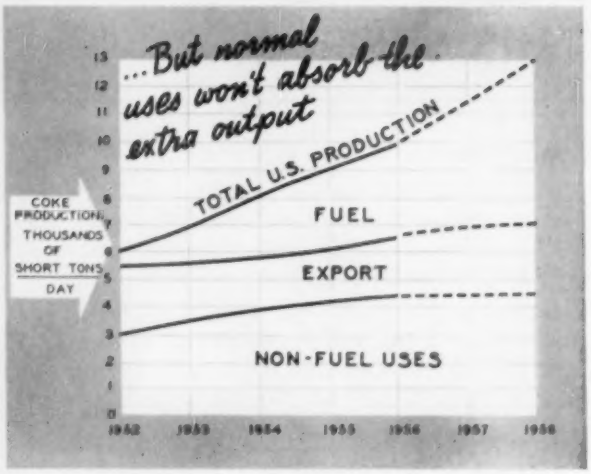
• Two Canadian firms are embarking on an ambitious $60 million project to extract oil from the world's greatest untapped reserves—the Athabasca tar sands. They claim 90 per cent of the oil can be recovered from the sands by means of dilution and centrifugal force. Even if this is successful, king-size refining headaches still remain. But the companies figure the fabulous stakes more than offset the risk involved.

• Bottom-hole heating is booming again in California's low-gravity fields. The reason: improved electrical heaters and closed systems for circulating hot water or hot oil. The treatment is paying off in increased oil production and lower pumping costs.

• The world's northernmost well has been brought in near the Arctic Ocean in Alaska. It's a gasser drilled to assure heating fuel for the Air Force at Point Barrow.

• Operators in ailing Spraberry field of West Texas have received a measure of relief from the Texas Railroad Commission. The permissible gas-oil ratio was doubled to 4,000:1. But output is expected to drop anyway.





With More Cokers Coming . . .

. . . Refiners Will Have Coke to Burn

George Weber

NEW cokers being built by U. S. refiners mean an over-supply of coke. And much of the output from these new units will wind up under somebody's boiler.

The new capacity is outstripping demands of coke's normal markets. As more cokers are built, refiners are literally going to have coke to burn.

Shortly after the Korean War, the U. S. coke supply was in fair balance with nonfuel demands. But in the past 3 years the swing to coking has changed this picture. Supply is up. Demand for coke in electrodes, abrasives, and carbide has not kept pace.

So refiners have been forced to consider their coke production more and more as just another fuel—particularly operators who process high-sulfur stocks.

The trend is evident among refiners currently planning or building new coking units. Some have contracted their coke output to nearby utilities in exchange for steam and electricity. Others plan to use coke as internal refinery fuel or sell to established processors or nearby chemical or manufacturing concerns.

The price outlook is not good in view of the growing oversupply. Refiners thus are not tempted to get into the carbon business by processing the coke and selling direct to specialty users.

Capacity gaining . . . A look at the building program for new cokers indicates a continuing long position on coke. But refiners pay little attention to this in deciding whether to adopt coking processes. They install these units for only one reason. Cokers permit a low-value residual to be upgraded to more profitable light and middle distillate.

Often refiners figure the price of by-product coke at zero in calculations for new units. If a refiner must add the value of his coke to show a profit, he is figuring things too closely. But refiners still are concerned with the long-range outlook for coke because whatever realization can be had from it will bear on the plant's profit picture.

Coking capacity in the United States today stands at 321,690 bbl. per stream day. These coking units are located in 33 refineries throughout the country and are capable of producing more than 10,000 tons of petroleum coke per stream day.

Now contracted or under construction are seven additional units with a total coke capacity of 2,580 tons daily. Five more units are in the design and planning stages. They would add 1,455 tons per day. In addition, two major oil companies on the East Coast and at least three in inland locations are considering going to coking. Their total coke output would run more than 1,500 tons daily.

This revived interest in delayed coking and the new activity in fluid coking have sent the projected production curve on a gradual rise for the next 3 years (see chart).

Where is it going? . . . Petroleum coke has four major end uses other than fuel. The traffic for these uses, however, moves indirectly from the refiner through the major processors and distributors of carbon products.

The largest of these uses is for carbon anodes in recovery of primary aluminum. For this purpose, petroleum coke has no competitor. The anodes are composed of both calcined and green coke and a pitch binder. Each pound of aluminum consumes the equivalent of 0.64 lb. of green petroleum coke.

But this coke must be low in sulfur content and other contaminants. Some coke which fails to meet specifications finds its way into anodes only by being blended with higher quality coke by the large carbon suppliers.

The record expansion in aluminum since the war has boosted demand for high-quality coke. Some new aluminum capacity is on the way but there is no substantial future boost in output to match the postwar growth. This means the outlook for coke in this industry is one of only gradual growth for the near future.

Canada's aluminum industry is responsible for a sizable coke export trade for U. S. processors. Canada's four coking refiners now produce 415 tons of salable coke per day. Aluminum plants there require nearly 1,000 tons of green coke daily. The deficit is covered by imports from the U. S.

These imports are expected to increase when Aluminum Co. of Canada completes a new plant at Kitimat, B. C. The plant is being enlarged from an 88,500-ton annual capacity to 331,500 tons by 1959.

Other uses . . . Graphite electrodes, consumed in the electrometallurgical and chlorine industries, are also made from petroleum coke. In this field is it much more difficult to pinpoint demand, but

the figures in the small table are considered conservative.

Carbon for the abrasives industry can come from petroleum coke and other sources. The consensus of analysts in this field indicates a fairly steady demand for 80 to 90 tons of coke per day. For manufacture of carbide, petroleum coke's share is more difficult to determine.

If all of today's carbide capacity were based entirely on petroleum coke for its carbon source, it would consume nearly 1,400 tons of green coke per day. But this is far from true, and manufacturers buy carbon from petroleum coke if and as it becomes competitive at their respective plant locations. While no firm figures can support the estimate, it is believed the carbide industry will use the equivalent of 125 to 150 tons of coke per day. Numerous other end uses are made of the carbon in petroleum coke, but they are small even in the aggregate.

The best estimate of where petroleum coke goes shows nonfuel uses declining from 49 per cent of total domestic production in 1952, to 43 per cent in 1955. Exports showed some decline. Fuel uses rose from 11 to 34 per cent during the past 4 years.

More to fuel . . . This rough estimate of where petroleum coke winds up, gives a fairly clear indication of what is in the cards for the next few years. As shown on the chart, the nonfuel uses will probably continue upward, but at a modest rate. It is practically impossible to forecast exports. Some shipments continue steadily on long-term contracts. But the movement of additional coke to foreign trade is dependent largely on the availability of the right quality product, at the right place at the right time.

With a nominal increase in nonfuel markets, the expected increase in coke production can only go to fuel. Where it finds this market and at what price, will depend entirely on factors attending each particular case.

If several recent developments along this line may be taken as a sign of the times, it appears much of the new coke coming onto the market won't travel very far.

Tide Water Associated Oil Co. is planning a 42,000-bbl. fluid coker at its new Delaware City refinery now under construction. Initially, the coke production of more than 500 tons daily will move next door to a power plant to be operated by Delaware Power & Light Co. There it will be pulverized and mixed with oil or another fuel of higher volatility for burning under steam boilers. Tide Water in turn will be supplied steam and electrical power by the utility.

Who's Coking Now . . . or Soon Will Be

UNITED STATES

Existing Units

Company and refinery location—	Type of process*	Charging capacity bbl./stream day	Coke capacity tons/stream day
Carter Oil Co., Billings, Mont.	F	3,800	210
Cities Service Oil Co., East Chicago, Ind.	D	8,900	440
Cities Service Oil Co., Ponca City, Okla.	O	1,950	100
Continental Oil Co., Ponca City, Okla.	D	7,200	400
D-X Sunray Oil Co., Duncan, Okla.	D	9,000	300
Frontier Refining Co., Cheyenne, Wyo.	D	3,500	115
General Petroleum Corp., Torrance, Calif.	D	26,000	1,100
Kendall Refining Co., Bradford, Pa.	O	1,500	25
McMurrey Refining Co., Tyler, Tex.	D	10,000	67
National Co-Op Ref. Assn., McPherson, Kans.	D	9,000	250
Ohio Oil Co., Robinson, Ill.	D	6,000	250
Pan-Am Southern Corp., Destrehan, La.	D	10,000	335
Pan-Am Southern Corp., El Dorado, Ark.	D	10,000	400
Portland Gas & Coke Co., Portland, Ore.	O	1,500	35
Pure Oil Co., Toledo, Ohio	D	5,000	175
Seattle Gas Co., Seattle, Wash.	O	4,000	100
Shell Oil Co., Wood River, Ill.	O	15,000	800
Socony-Mobil Oil Co., East St. Louis, Ill.	D	9,000	266
Socony-Mobil Oil Co., Trenton, Mich.	D	4,000	160
Standard Oil Co. (Ind.), Casper, Wyo.	O	2,500	118
Standard Oil Co. (Ind.), Neodesha, Kans.	O	5,100	85
Standard Oil Co. (Ind.), Sugar Creek, Mo.	O	30,400	505
Standard Oil Co. (Ind.), Whiting, Ind.	D	41,000	930
Standard Oil Co. (Ind.), Wood River, Ill.	O	2,740	126
Standard Oil Co. (Ohio), Lima, Ohio	D	19,500	320
Standard Oil Co. (Ohio), Toledo, Ohio	D	7,000	180
The Texas Co., Amarillo, Tex.	D	3,600	100
The Texas Co., Casper, Wyo.	O	4,000	100
The Texas Co., El Paso, Tex.	D	2,800	89
The Texas Co., Lockport, Ill.	O	12,000	250
The Texas Co., Port Arthur, Tex.	O	7,000	200
Union Oil Co. of California, Rodeo, Calif.	D	20,000	1,000
Union Oil Co. of California, Santa Maria, Calif.	D	18,700	550
Building or Contracted Units			
American Oil Co., Yorktown, Va.	D	10,000	500
Aurora Gasoline Co., Detroit, Mich.	F	4,000	100
D-X Sunray Oil Co., Tulsa, Okla.	D	7,000	240
Esso Standard Oil Co., Baltimore, Md.	F	10,000	140
Great Northern Oil Co., Pine Bend, Minn.	D	10,000	450
Tide Water Assoc. Oil Co., Delaware City, Del.	F	42,000	(est.) 575
Tide Water Assoc. Oil Co., Avon, Calif.	F	42,000	(est.) 575
Planned Units			
Standard Oil Co. (Ind.), Wood River, Ill.	(?)	9,500	330
American Gilsonite Co., Fruita, Colo.	D		325
Commerce Oil Refining Corp., Portsmouth, R. I.	D	(?)	(?)
Vickers Petroleum Co., Potwin, Kans.	(?)	(?)	(?)
Esso Standard Oil Co., Baton Rouge, La.	F	20,000	800
CANADA			
Existing Units			
British American Oil Co., Ltd., Edmonton, Alta.	D	2,100	60
British American Oil Co., Ltd., Moose Jaw, Sask.	D	2,250	100
Imperial Oil, Ltd., Sarnia, Ont.	D	28,860	266
McColl-Frontenac Oil Co., Ltd., Edmonton, Alta.	D	2,200	60
Building			
Canadian Petrofina, Ltd., Montreal, Que.	F	3,800	135

*D—Delayed coke process; F—Fluid coking process; O—Chamber or other process.

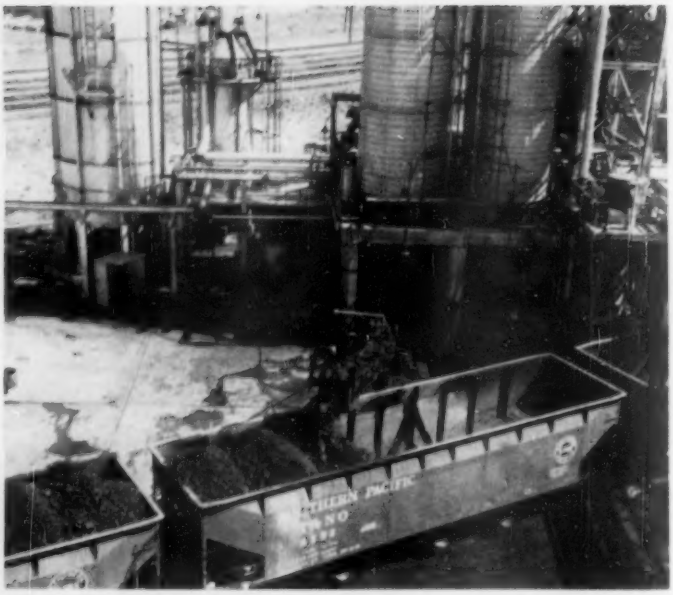
Eventually Tide Water may use some of this coke for firing the 130,000-bbl. per day crude furnace at the new refinery. Its design will permit this, but the pulverizing equipment and other handling facilities will not be installed at first.

Another new East Coast refinery, the Yorktown, Va., plant of American Oil Co., also will include a coker. This one will use the delayed coking process, employing fairly high recycle rates and producing about 500 tons of solid fuel per day. This product also will move next door to a new power plant being built by Virginia Electric Power Co. Roughly the same reciprocal agreement on steam and electric power will hold in this case.

A third large coker is now nearing completion at the Baltimore refinery of Esso Standard Oil Co. This fluid coker will produce about 140 tons per stream day. The company is understood to be negotiating a sales contract for this coke with a utility in New Jersey.

Aurora Gasoline Co.'s new fluid coker, expected to go on stream early

ANOTHER NEW COKER is this 10,000-bbl. unit at the Tyler, Tex., refinery of McMurrey Refining Co.



DIRECT LOADING into rail cars is a feature of the new McMurrey installation. The 10,000-bbl. unit has a daily output of only 67 tons of coke.

next year, does not yet have a firm outlet for its coke production. The company currently is talking to several prospective purchasers for both fuel and other possible uses. On the West Coast, Tide Water is starting work on a large fluid coker identical to the one in Delaware.

A major company in the Chicago area reports the coke market there is poor. The company is now planning to install pulverizing equipment to utilize a part of its plant production with oil under its own heaters. This practice may be adopted by other inland refiners if the coke market continues soft as indicated.

Burning equipment . . . Use of petroleum coke under boilers is not new. It has been practiced, particularly on the West Coast, for several years. According to combustion engineers, delayed coke poses no special problems over those encountered with powdered coal.

It appears the most likely outlet for coke in excess of demand for the non-fuel uses will be the utility companies and the refiners themselves. In the past, some coke was briquetted and sold as household fuel. But the inroads of gas and heating oil have spelled the end to this market.

In one new project based on bituminous coal and delayed coke, a utility company is installing conventional pulverizers and proportioners which will permit close control of the ratio to be burned. The coke from the drums will be stockpiled for water removal then removed to a bunker at the adjacent steam plant. The proportioning equipment is placed ahead of the pulverizer, so that the mixing takes place immediately ahead of the blowers. Abrasion of the delayed coke is about the same as a medium soft coal, and it shows a grindability of about 98. Eventually, the utility company plans to increase the proportion of coke to about 85 per cent of total fuel mix.

What of fluid coke? . . . It is still too early to draw many firm conclusions on how fluid coke will best be utilized. At this stage it will find its principal use as a fuel. Further investigations are being carried on to develop other possible outlets.

Like petroleum coke, fluid coke generally is the byproduct. Its particular characteristics have only an indirect bearing on the decision to adopt fluid coking over other processes. The yield and quality of light and middle distillates primarily influence the refiner's choice. But an intensive study on possible other uses of fluid coke is being made to enhance the refiner's return on the process.

The sole commercial fluid coker to date—that of Carter Oil Co. at Billings, Mont.—has enjoyed a firm demand for all its production. Carter's fluid coke has moved to both the East and West coasts and many points between for marketing tests.

Preliminary evaluations indicate fluid coke will definitely find its place in the market as a fuel. But at the present stage of development, this new type of solid fuel will require higher investment and operating costs than the same amount of delayed coke or soft coal.

The general outlook . . . It is generally conceded that petroleum coke of all types is going to show a decline in the qualities by which prospective buyers judge it. This is true for two reasons.

The over-all percentage of higher sulfur crudes charged to stills in the U. S. is gradually rising. The sulfur tends to become concentrated in heavy fuel and coke.

Furthermore, refiners are gradually turning their coker charge stocks to heavier and heavier fractions, recovering more catalytic charge stocks from the residual fraction.

This gradual downgrading of all coke, coupled with the increasing supply does not indicate an improved market for coke generally. It is impossible to generalize on coke prices. They vary according to location and quality. Even in some established contracts where a plant's full production is going to a nearby utility for fuel, the price does not remain stable. It is subject to the quality changes which result from variations in crude charges and operating conditions.

Location of the coke supply is an important factor in both its fuel and non-fuel market. Transportation costs to processing points and then to markets comprise a large share of the final price of calcined coke. The relation of gas, coal and oil prices in various parts of the country also affect the price which the refiner can expect for his coke.

Conditions discourage refiners from attempting to increase their profit on coke by entering the jobbing and processing business. Many have found on investigation that the costs and losses

Where U.S. Coke Goes

(1,000 tons/year)

	1952	1953	1954	1955
Domestic production	2,215	2,536	2,956	3,300
Domestic consumption:				
Aluminum anodes	596	794	940	975
Graphite electrodes	230	235	190	235
Abrasives	80	85	90	85
Carbide and miscl.	190	170	160	145
Fuel	242	520	921	1,110
Total domestic consumption	1,338	1,804	2,301	2,550
Exports	877	732	655	750

of transportation and processing would wipe out the price differential between their green coke and calcined coke needed by electrode makers.

The major coke processors also are able to buy coke of varying quality. By blending off poor quality coke in large-scale operations, they can create non-fuel uses for some coke which normally would go only into fuel. On the whole they are believed to operate on a reasonable profit basis.

The extended future . . . It is possible the current trend toward coking may one day yield to alternate processing of residuals in refineries. There is much current interest in charging a whole reduced crude to catalytic cracking operations.

One process, called Houdresid, was introduced this year by Houdry Process Corp. to perform this function. To date this process is operating in one refinery, although numerous refiners are reported to have expressed interest in adapting it to their operations.

Some other companies are blending residuals into their catalytic cracking feed stocks and one is charging a total residual. But the latter case concerns a unique crude which is low in metal contaminants. The economic pressure for converting more residuals to distillate presently favors coking. But if further catalyst improvements result from current intensive research, refiners in the future may swing away from thermal coking and toward catalytic processing of heavy fractions.

Another development affecting residual processing appeared on the horizon this spring. Gulf Oil Corp. announced its HDS process. This entails the hydrogenation of whole crude or heavy fractions to remove sulfur and partially convert residuals to distillates. This is a fairly high cost operation, and its economic justification will depend on the price of heavy fuel. No commercial plants of this type have been contracted to date, but it is considered to offer an alternate possibility to coking—at some time in the future.

Still another factor affecting the coking of residuals, arises from the adoption of coking itself. In some areas, where the price of heavy fuel was depressed, the adoption of coking by one refiner might remove enough heavy fuel from the market to improve its price. It then becomes less urgent for other refiners to follow suit. This has happened in some local refining areas. It may happen in more.

For the present and immediate future, refiners who are coking or planning to do so will do well to keep abreast of the factors which affect the price of coke in their respective areas. If their coke is a low-sulfur product, they may strike the best bargain with buyers and processors for the electrode or chemical market.

If their product is high in sulfur, or difficult to process for carbon uses, local utilities may be interested in it. If the going market price is too low, they should investigate the economics of converting their own furnaces for coke. The competitive position of coke can readily be judged against the going price of gas and heavy fuel oil in each respective case.

The prospect of increased coke burning has alerted designers and manufacturers of combustion equipment to take a closer look at the problems involved in handling and grinding the fuel. The result should be an improvement in methods for handling this type of fuel under boilers and furnaces.

The refiner who is considering installing a new coker should still largely disregard the value of the coke in his economic studies. But a thorough look at the market possibilities for coke is still in order. In this study, there is no set pattern to follow. Each case must be judged on its own merits.

Union Sued for Damages

CAMDEN, N. J.—The Texas Co. told a federal District Court here last week it cost the company $74,226 to shut down its Eagle Point refinery when workers refused to cross a maritime union picket line. The company asked the refinery workers' union to pay the bill.

The oil company filed suit for breach of contract against the Oil, Chemical and Atomic Workers International Union, CIO, and Local 12-638 at Westville, N. J., site of the refinery.

The refinery was shut down June 20 when the National Maritime Union threw up a picket line around the plant during a strike with tanker operators. Refinery workers refused to cross the picket line. The Texas Co. claimed this violated its contract with the refinery union.

Refining Briefs

WASHINGTON. — A Bureau of Mines refinery survey shows capacity in the United States stood at 8,420,630 bbl. daily at the beginning of 1955. Secretary of the Interior Douglas McKay said the figure was 400,000 bbl. daily greater than the 1954 capacity. The Oil and Gas Journal's annual refinery survey placed capacity as of January 1, 1955, at 8,639,255 bbl. daily *(The Oil and Gas Journal, March 21, page 208).*

HOUSTON.—Consolidated Chemical Industries, Houston, has started operating two sludge acid regeneration plants, which cost about $8,000,000. The plants, located at Baytown, Tex., and Houston, add 280,000 tons a year capacity to the company's present output of regenerated sulfuric acid. Both plants are designed so that they utilize the fuel value of the sludge itself.

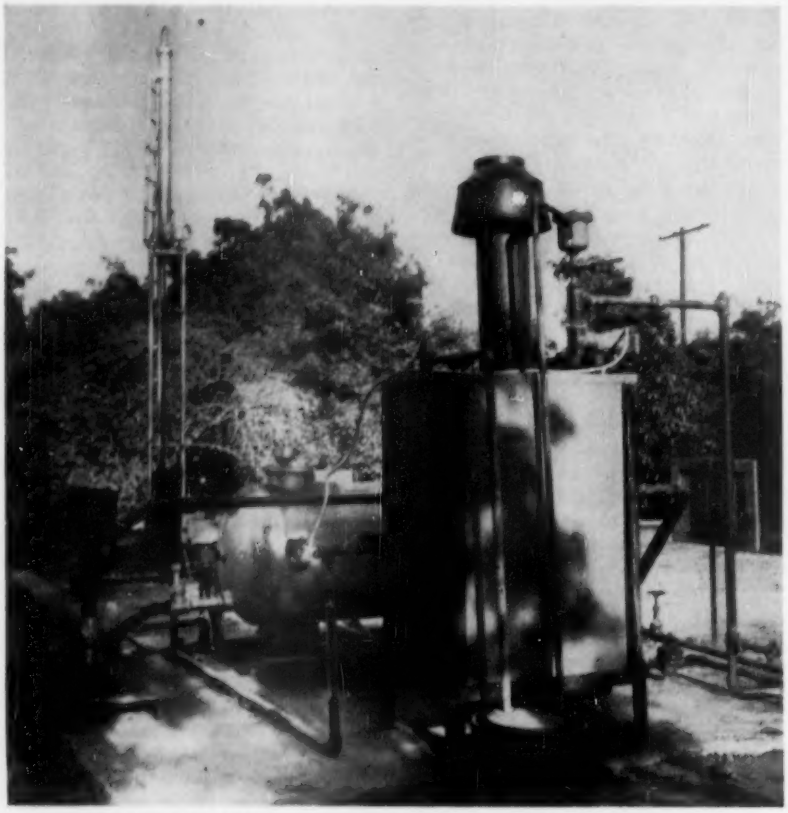
LOUISVILLE, Ky.—Tennessee East-man Co. has awarded the engineering contract for its high-purity hydrogen plant at Kingsport, Tenn., to Girdler Co., which also will supply process equipment. The Hygirtol unit will use the steam-hydrocarbon reforming process with natural gas as feed stock.

BILLINGS, Mont. — Involuntary bankruptcy proceedings and an attachment suit have been filed in U. S. District Court here against Modern Oil Co. of Montana, Inc., which operates a 1,000-bbl. daily refinery at Shelby. Three creditors asked $150,000 in the bankruptcy action. Ohio Oil Co. is seeking to recover payment for natural gas in its attachment suit.

LOS ANGELES.—Fletcher Oil Co. is nearing completion of the new 10,000-bbl. crude topping unit it is building at its Wilmington refinery. The new facilities, which will replace a 5,000-bbl. unit, are expected to be on stream by October 1.

LOS ANGELES.—Federal, state, and city officials will begin a study of the Los Angeles "smog" problem September 1. The officials will study the effluents released to the air by oil refineries and power generating plants in the area.

LOS ANGELES. — The Texas Co. has gone on stream with a 10,000-bbl. Platformer and a 10,000-bbl. Hydrotreater at its Wilmington, Calif., refinery. The units are part of a $77,000,000 investment that Texaco made in 1954 to increase the octane rating of its gasoline.



YORBA LINDA heavy oil gets the heat treatment from this installation.

In shallow, low-gravity pools . . .

Formation Heaters Pay

D. H. Stormont

LOS ANGELES.—Bottom-hole heating is getting a bigger workout in California's low-gravity fields.

Heaters are not a new idea. Steam generators, electrical heaters, and other devices have been under study for years. But new improvements in electrical heaters and in closed systems for circulating hot water or hot oil are resulting in a wider application of the idea.

In most cases—particularly in wells producing high-viscosity crude — the heaters are paying off with increased oil production and lower pumping costs. In some cases they eliminate or reduce sanding problems, cut pump pressures, increase pump efficiency, and lower crude-treating costs.

Some idea of their effectiveness is shown by a recent study of more than 200 heater installations. It was found that they increased production an average of 12 bbl. daily per well.

New applications . . . Most heaters are used in partly depleted pools yielding 11° to 15° gravity crude. Most are also in wells less than 2,000 ft. deep. Their use in new wells, however, is increasing.

At Yorba Linda, Western Gulf Oil Co. is using them extensively to improve the economics of its operation. Here the company is developing a 500-ft. zone containing 13° crude. It is using a company-designed hot-water circulating system.

At Huntington Beach, where more than 200 wells have been drilled in a recent town-lot drilling flurry, some operators are using various types of heaters in an effort to realize a payout.

At Yorba Linda . . . A spreading practice insofar as gas-fired heaters are concerned is the use of finned tubing within the oil zone. This practice was pioneered by Western Gulf at Yorba Linda. There some 100 ft. of ¾-in. finned tubing is used to heat the oil formation.

This down-the-well heating program is being applied to 16 shallow wells. The 13°-gravity crude has a viscosity of about 45,000 seconds at a temperature of 85° F. By heating it to 150° F., with 230° F. water circulated at the rate of 8 gal. per minute and at 40-psi. pressure, viscosity is reduced to 2,000 seconds.

Cost of operating the heater and pump is about $1 per day when fueled with gas valued at 17 cents per M.c.f. Comparative tests with and without bottom-hole heating have shown that heating results in a production gain of about 8 bbl. per day per well. This gain pays the cost of the heating facilities in about 3 months.

At Midway-Sunset . . . A similar production increase is being realized at a 13-well project in the Midway-Sunset area.

There hot oil is circulated, entering the well at 240° F. and returning at 160° F. This heats the low-gravity crude to 110° or 120° F. Output has jumped from 123 to 213 bbl. daily, or an average increase of 7 bbl. per well.

Cost of these heaters was about $2,600 each, plus a $300 installation charge. It is estimated they will pay out in about 24 months. Whenever heating is interrupted for any reason, output of the old wells soon returns to normal.

Cost comparisons . . . The automatic heaters used to circulate hot water or oil down the wells are quite satisfactory where no great depths are involved. Studies carried out by one company show that after making reasonable allowances for surface and upper-hole heat losses, gas-fired heaters hold a three-to-one margin over electrical heaters in 500-ft. wells. At about 2,000 ft. the two methods are equally efficient.

Below that depth the high losses experienced with circulating heaters may make electric heaters the less expensive. The studies were based on a fuel gas at 30 cents per M.c.f. and 1 cent per kw.-hr. electricity.

In order to increase the depth at which circulating type heaters can be profitably applied, efforts are being made to insulate the line carrying fluid down the hole.

Another manufacturer plans to produce soon a unit designed for steam operation. Individual generators at each well will supply 500-psi. steam to operate a steam-powered pumping jack. Exhaust steam will then be used for down-the-hole heating and for wash-tank heating.

New Down-Hole Tool

Cutoff and perforating device uses fluorine compounds to eat through tubular goods; it even "drills" hard rock

Ed McGhee

HOUSTON.—A promising new chemically powered cutoff and perforating tool for oil-well tubular goods has just been unveiled here. Making use of highly active fluorine compounds to react with the steel, the device can be arranged to give either a complete cutoff or a single perforation.

Here are some of the uses its developers see for it:

. . . A tubing cutoff tool, already in successful field use.

. . . A casing and drill-pipe cutoff tool, ready for the field soon.

. . . A tubing perforator for use inside casing.

. . . A casing perforator for completions.

. . . A cleanup for bit cones and other junk on the bottom of the hole.

. . . A perforator of very thick drill collars to make fishing easier.

. . . A means to "drill" through extremely hard formations that now call for diamond bits.

Engineers of McCullough Tool Co. developed the method in cooperation with Pennsylvania Salt Mfg. Co. They report the tubing cutter already has been used successfully in several hundred field jobs. At present, this is the only form in which the chemical method is available. McCullough expects to make the other applications ready for field use as soon as possible.

How it works . . . The charge in this new cutter is not elemental fluorine, but a compound of fluorine and other members of the halogen family. McCullough did not reveal the exact compound now in use but about 1 to 1½ lb. of it are carried in the cutter.

The cutter tool also carries a section containing a slow-burning explosive similar to that used in wire-line packer setting tools. This explosive is detonated electrically. The pressure from it forces the chemical out against the tubing. Since the chemical will not by itself react with steel, the cutter tool carries a catalyst to promote quick action of the chemical against the tubing. Reaction time with the catalyst is almost instantaneous.

At the extreme end of the tool is the cutter head which guides the chemical against the steel. Arranged around this head is a row of evenly spaced orifices or nozzles which are the key to the type of cut made in the tubing. When the chemical is forced out through all

the nozzles in the ring, an even cut is made. If a cutting head with only a single orifice were used, the result would be a single perforation through the tubing.

A natural advantage . . . McCullough engineers say the fluorine-reaction process has a natural advantage. The size of its "power source" is not limited by the diameter of the hole. The height of the liquid chemical can be raised until there is enough volume to do the job, regardless of the small diameter of the hole. In other words, the tools can be extremely long and thin—or short and thick, just as needed.

This is not true for shaped charges and explosive cutters. They must be carried horizontally. They can be no bigger than the hole diameter allows. However, like shaped charges and explosive cutters, the chemical cutter is run on a wire line. And, of course, wire-line tools make a great saving in rig time over mechanical cutters run on sucker rods or small-diameter pipe.

Moreover, the chemical cutter does not flare out the tubing like an explosive tool does. Therefore, the pipe can be caught by an overshot immediately after the cut is made.

While the fluorine cutting tools are slightly more expensive than the regular string shot for backing off stuck pipe, they have the advantage of not requiring rotation of the pipe. Only a slight strain need be taken on the stuck string.

It can be controlled . . . One interesting feature McCullough claims for its new chemical tools is control. The action may be adjusted so that the tubing may be cut without damaging the casing in any way. Likewise, a single perforation may be made cleanly through the tubing without making so much as a pit in the casing, even if the casing is only ⅛ in. away.

This control of the chemical cutting is possible through three factors. First, the pressure that forces the chemical out of the tool may be regulated. Second, the amount of chemical can be varied for the best effect. Then, the nozzles in the cutting head can be made of several different designs.

To make certain that it holds steady during its cut, McCullough has put button-type slips on the upper end of the cutting tool. These are actuated by the same explosive that expels the chemical.

Future application . . . McCullough has high hopes for the chemical tool. They expect that it can be adapted for any cutting or perforating service in a well, including perforating the thickest of drill collars. Moreover, in experimental work, the chemical tools have "made hole" in typical well formations. McCullough thinks that is likely that the fluorine method can be used economically in extremely hard formations that now call for diamond bits.

Discovery Tested

Important Beaver well is rated good producer

TULSA. — Potential tests have rated Union Oil Co. of California's important wildcat in southern Beaver County of the Oklahoma Panhandle a valuable producer.

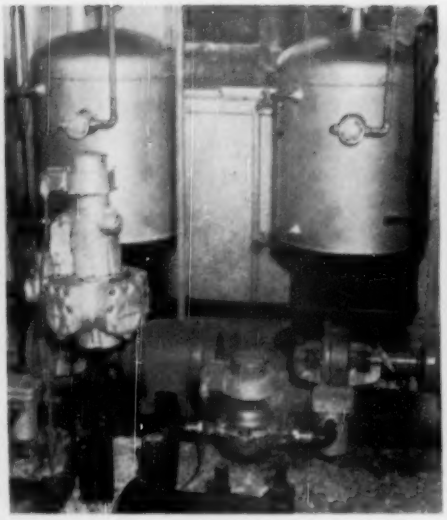
The firm's 1 Parker flowed 4,400 M.c.f. of gas per day based on a 16-hour test of treated Morrow sand perforations at 7,096-7,110 ft. It also flowed 75 bbl. of 60°-gravity distillate. Gas-distillate ratio is 58,666:1.

Flow of gas and distillate was through 22/64-in. choke. Tubing pressure at beginning of the test was 1,600 psi. and 1,610 psi. at the end. Casing pressure at the start and end remained at 1,675 psi.

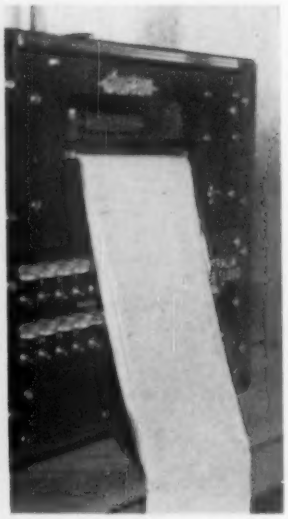
Earlier an open-flow test of 150,000 M.c.f. of gas per day was reported. The big flow was believed a conservative estimate of the well's worth.

The 1 Parker is the most significant strike of the year in the Oklahoma Panhandle. It is in an area which has experienced little drilling and no production. It is 8 miles southwest of nearest production in the Southwest Camp Creek area.

1 Electric motors control valves on each well. Operator can push remote button and automatically take sample from selected well for testing.



2 Oil and water are metered automatically after well test sample goes through separation in heater treater.



3 Results are recorded automatically. Note push buttons for controlling individual wells.

Centralia Flood Readied

Newest in surface equipment being installed as Shell gets ready to flood 1,930-acre unit in latest Illinois project

CENTRALIA, Ill.—The last of Illinois' older fields is about to succumb to water flooding.

Construction is now in progress on ultramodern well-testing, injection, and treating equipment for the big field.

Surface facilities for the Centralia Water Flood Unit are being installed by Refinery Engineering Co. The plants for oil treating and storage, water treating, and injection will be completely centralized. There will be 53 miles of pipe in the injection and flood-return system, and four 5,000-bbl. tanks for oil storage.

Shell Oil Co., designated the unit operator, will have push-button control of well testing to keep constant watch on the field's reaction to flooding. Eight automatic testing units will enable the operator to sample production and measure the water and oil being produced by any given well at any time.

The automatic test can be set up to check every well in the field at 12 or 24-hour intervals. If the operator wants to interrupt the test cycle to observe a particular well, he can shut off the others by pressing buttons at the central recorder for each unit.

The installation will be Shell's first use of the automatic test system in the Mid-Continent area.

Water treatment also will be automatically controlled. The injection system will be electrically operated with pressure and emergency cutoff controls at a central point.

The unit covers 1,930 acres of Centralia field and embraces 13 operators and almost 240 royalty owners. Forty-nine individual tracts with production from the Benoist and Cypress formations will be operated as a single lease.

More wells drilling . . . Twenty-four additional wells are being drilled, including 11 for water injection and 13 oil producers. They will bring the total to 99 water injection and 109 producing wells, the number recommended by engineers for maximum recovery.

A 20-acre, five-spot flood pattern was decided on as the most efficent flood method for the field. Generally the arrangement will be an injection well at each corner of a 20-acre tract with a producing well in the center.

Centralia joins Loudon and Salem, the other old fields of the state's boom days, in unitization for secondary recovery.

The Centralia flood is not big compared with Salem, which dwarfs all other such projects in Illinois and even has a greater water-injection volume than the 50,000-acre SACROC Unit in Texas. Salem's daily injection rate may reach 200,000 bbl. per day compared with Centralia's initial 15,000 bbl.

A water supply will be no problem in Centralia. In fact, the flood will help solve present salt-water disposal difficulties. Salt water is being produced along with oil from the Devonian reservoir.

This supply is more than adequate to fill injection requirements. Although tests show it to be unfit for domestic use, the brine can be economically treated for flooding.

Output waning . . . Centralia field, in the almost 18 years since its discovery, has produced more than 38,000,000 bbl. of oil. Output in recent years has been declining rapidly. Production of 841,941 bbl. in 1952 dropped more than 15 per cent to 709,395 bbl. the following year.

Water flooding is expected to result in recovery of an additional 2,000,000 bbl. of oil. Royalty owners will share in production according to their percentage of participation.

The unit includes almost all of the Cypress and Benoist production, which comprises roughly half of Centralia field.

Operators in the unit, besides Shell, are Sohio Petroleum Co., Gulf Oil Corp., W. C. McBride, Inc., Rock Hill Oil Co., Aberdeen Petroleum Co., E. M. Self, John Powell, Fred Seip, Aaron Karchmer, Nick Babare, C. F. Beaver, and J. A. Talbot.

The Centralia boom was touched off by Adams Oil & Gas Co.'s discovery in November 1937. The producer came in at 161 bbl. per day from the Benoist at 1,350 ft. There were 727 holes sunk in the drilling rush that followed, and more than 550 wells are still producing. All are on artificial lift. The average gravity of the oil is 39°.

Spraberry Gets Relief

Texas Railroad Commission doubles gas-oil ratio for ailing field; but it refuses to impose controls on a lease basis

AUSTIN.—Operators in Spraberry Trend Area of West Texas received a measure of relief for the huge ailing reservoir last week from the Texas Railroad Commission.

The commission raised the permissible producing gas-oil ratio from the state-wide 2,000:1 to 4,000:1 effective August 1. Phillips Petroleum Co. had proposed the change in June.

Commissioners, however, refused other Phillips-proposed remedies for the field. These included oil allowables on a lease basis, gas limits and gas-oil ratios for leases.

Sources close to the commission said members felt they could not legally approve production or control of production on a lease basis. Such a policy, they felt, would mean a bitter fight over correlative-rights violation in Spraberry. Such a move also might set a precedent for similar requests for other fields.

On the other hand, regulation on a lease basis would have greatly simplified the commission's task of policing production in the Spraberry. As the rules stand now, gas-oil ratio surveys must be carried out by the operators on each Spraberry well twice a year.

Output to drop . . . Even with the permissible gas-oil ratio doubled, Spraberry oil and gas production will drop starting this month.

Production recently has been on a wide-open basis in most areas of the field, with the former 2,000:1 ratio not enforced. The first general G.O.R. survey in many months was conducted in April, May, and June. The results, tabulated in July, showed Spraberry wells were producing at a weighted-average ratio of 4,872:1. Producers in the southern, or District 7-C, portion of the field apparently were in much better shape, with a weighted average ratio of 3,867:1 as compared to 7,330:1 in the northern (District 8) end. In the oldest portion of the field, the Tex Harvey area, ratios were averaging close to 11,000:1.

Just how much production will drop remains to be seen. Some think it will be around 10 per cent for both oil and gas. This will pinch the operators but not nearly so much as if the 2,000:1 G.O.R. had been left in effect and enforced.

Effect on allowables . . . Top daily allowable for a Spraberry well is 121 bbl. on 80 acres, 212 bbl. on 160 acres.

In Texas, actual oil allowable of a well is figured by multiplying the top daily oil allowable in the field by the permissible gas-oil ratio to get the daily gas limit. The daily gas limit then is divided by the well's actual gas-oil ratio to get the oil allowable.

Taking a hypothetical well on 80 acres producing at 4,872:1 (the weighted average G.O.R. for the field as determined by the April-May-June survey), the oil allowable under the 4,000:1 permissible ratio would be 99 bbl. daily—on 160 acres, 174 bbl. daily.

The hypothetical well in the north end of the field on 80 acres (weighted average G.O.R. of 7,330:1) would have an oil allowable of only 66 bbl.—and 115 bbl. on 160 acres.

To illustrate what the raise in permissible gas-oil ratio means to the Spraberry producer, compare the last example with what the producer's oil allowable would be under an enforced 2,000:1 ratio.

In such an instance with a well having a G.O.R. of 7,330:1, the producer would have an oil allowable of only 33 bbl. daily on 80 acres, 58 bbl. on 160 acres.

Troubles recognized . . . It is apparent from the ruling the commission realizes Spraberry operators are in trouble. It accepts claims of Phillips and others that a large number of Spraberry's roughly 2,400 wells would have to be abandoned if the 2,000:1 ratio were enforced.

The decision is no cure-all for the field *(The Oil and Gas Journal, June 13, page 126)*. Many operators will still take a beating in the Spraberry. But the commission's action, most agree, will prevent many premature abandonments and hike the ultimate recovery of Spraberry's tightly held oil.

Drillers Go 40 Miles Offshore as . . .

. . . Phillips Tests Costly Tract

MORGAN CITY, La.—Phillips Petroleum Co. is rigging up to drill its first test on an expensive tidelands lease 40 miles from the Louisiana coast. The location is farther from shore than any well yet drilled in the Gulf of Mexico.

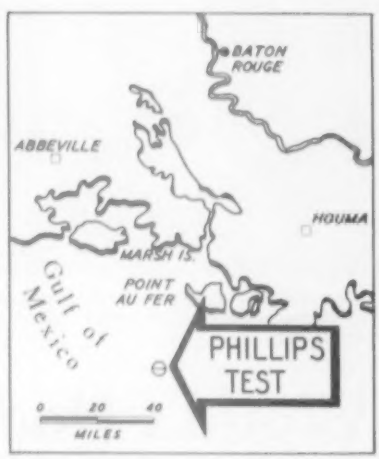
The wildcat will be drilled in Block 184, Eugene Island area, off the coast of St. Mary Parish. Location will be in water about 85 ft. deep, 12 miles south of nearest production in Blocks 128 and 129 of the same area.

Phillips will drill the well from its new self-contained platform with a diesel-electric rig. The first storm of the hurricane season last week delayed moving equipment to the well site. The company now plans to start operations within 2 or 3 weeks.

Block to be tested first is the south half of a 10,000-acre tract leased by Phillips in the federal Government's first big offshore lease sale last October. Phillips paid bonuses totaling $7,332,000 for Blocks 172 and 184 which comprise the submerged tract.

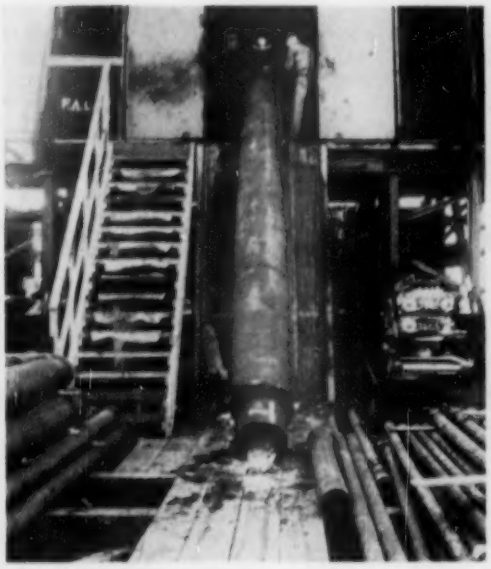
At the same sale, Humble Oil & Refining Co. acquired 10,000 acres just east of the Phillips' blocks for bids totaling only $227,400.

The Phillips well exceeds by several miles the seaward distance of other tidelands wells. Gulf Oil Corp. is now drilling about 30 to 35 miles from shore in the East Cameron and Ship Shoal areas. The C.A.T.C. group of four companies has a shut-in gas field about 30 miles off Cameron Parish.

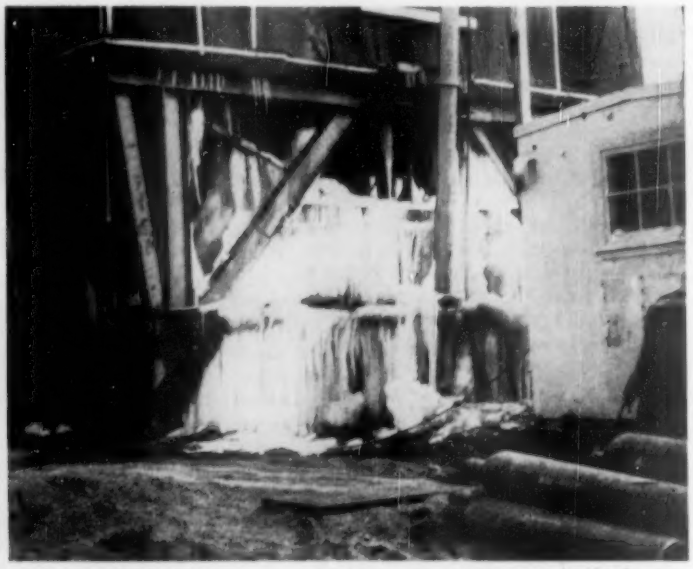


Phillips also plans to start drilling soon on another high-priced offshore lease in the Eugene Island area. The test will be in Block 129-A, a 3,824-acre tract for which it paid $4,166,000. This acreage is about 30 miles from shore. An Offshore Drilling Co. barge to be used in this test slipped during jacking-up operations and has been taken to New Orleans for repairs and modifications. This will mean a 30-day delay in operations.

MIDSUMMER DRILLING—in Alaska—finds the sun on the horizon and snow everywhere.



SURFACE PIPE was especially insulated to prevent thawing of the permafrost. The 11¾-in. casing was enclosed in 18-in. pipe.



MAJOR PROBLEM was ice on the Point Barrow drilling job. Huge icicles and sheets of ice encase part of the substructure. This photograph was made early in June, only a few weeks after the well was spudded in.

World's Northernmost Well Is Gasser

POINT BARROW, Alaska.—A new gas well has been brought in near the Arctic Ocean for what probably is the world's northernmost producer. The gasser will assure heat this winter for U. S. airmen stationed on the tip of Alaska.

The well was drilled near Point Barrow by contract crews of A. D. Rushing, Inc., Los Angeles, and already has been tied into the government pipeline system serving the Air Force Arctic Research Laboratory and other defense installations here.

The well is located on the 25,000,000-acre Petroleum Reserve No. 4, which the Navy reserved in 1953 for a large-scale exploration program. The Air Force had been using gas from a single well in the Point Barrow area, but this well failed last Christmas.

When that well stopped flowing in mid-winter, a petroleum engineer was rushed to Alaska to restore production. The Air Force then decided to ask the Navy's permission to drill a standby well to guarantee a fuel supply in the event of another failure.

Crews flown in . . . The Rushing firm sent rig builders to Alaska by plane in early April. Head Rig Builder Pat Fitzpatrick of Whittier, Calif., and his crew dismantled a Navy derrick located 300 miles from Point Barrow. The derrick and other Navy drilling equipment were transported to the drill site before the spring thaw.

A Rushing drilling crew then was flown to Point Barrow on May 13. The well was spudded May 17 and completed June 17 at 2,600 ft.

Eugene L. Davis, an old hand at Alaskan operations, was petroleum engineer on the job. The month's drilling project, he said, was accomplished with little trouble. Ice on the rig was the major problem.

Davis used an 18-in. outer shell around 11¾-in. surface pipe so that the warm drilling mud would not thaw the permafrost and turn the drilling site into a quagmire.

Gas at Gubik . . . Gas production is not new to this northern tip of Alaska. The Navy during its exploration program discovered the Gubik gas field just at the edge of Reserve No. 4. It lies mostly on lands outside the reserve but in an area withdrawn from public leasing for the past 12 years.

The Interior Department is planning to open to public leasing more than 20 million acres of this land adjoining the reserve. It is awaiting approval of the plan by the House and Senate armed forces and interior affairs committees.

Alaskan interests hope to lease the Gubik area, develop the gas field and promote a natural-gas pipeline to Fairbanks. If additional reserves are found, they plan to extend the proposed line to Anchorage.

Gubik field was the biggest gas find made by the Navy during its huge exploration program. The structure is an east-west anticline. Gas was found in rocks of Cretaceous age. Formations penetrated were described as similar to those in the Rocky Mountains and Canada.

When the area was withdrawn from public leasing, officials believed oil and gas deposits might be found in the Naval Reserve and surrounding territory. The Navy, however, in 9 years of testing, found only a moderate-sized oil field—Umiat—and the gas deposits at Gubik. The Navy has said it has no objections to releasing the lands lying outside the reserve.

Seeps Near Denver Tested

DENVER.—Great Basins Petroleum Co., Denver, is drilling its second well in a series of shallow wildcats near Morrison, 13 miles southwest of here, in an effort to develop production near oil seeps.

The initial attempt was abandoned as a dry hole at 610 ft., the company said. The tests are being made on leases covering about 3,000 acres held by Overland Oil, Inc., Denver.

The test program was undertaken after core-drilling operations by uranium prospectors found numerous oil shows.

Shut-In Order Is Lifted

DENVER.—A shut-in order has been lifted for wells producing only gas from the J sand pool of the Dakota series in the Little Beaver field in Washington and Adams counties, Colorado.

The state Oil and Gas Conservation Commission lifted the ban August 1. On that day Natural Gas Producers, Inc., began piping 4,000,000 cu. ft. of gas daily from the field to Colorado Interstate Gas Co.'s 20-in. line running from Hugoton, Kans., to Denver. N.G.P., a subsidiary of Colorado Interstate, picks up the gas at a gasoline plant operated in the field by Continental Oil Co.

The new order also prohibits flaring of gas from oil wells in the J sand pool, now that there is a market outlet for the fuel.

The commission also announced establishment of 40-acre drilling and spacing units for oil production and 320-acre units for gas production from the D sand of Pinneo field in Morgan County.

Coker on Stream

Esso unit completed while Tide Water starts another

BALTIMORE, Md. — The second fluid coker in the United States, a 10,000-bbl. daily unit, is being placed on stream at Esso Standard Oil Co.'s refinery here. It will produce about 140 tons of coke per stream day.

The fluid coker is the first to operate on the East Coast. Tide Water Associated Oil Co. has begun construction of the world's largest fluid unit at Avon, Calif. Charge stock will be 42,000 bbl. per day with an output of 575 tons of coke. Completion is scheduled for May 1956.

Bechtel Corp., San Francisco, has the engineering contract. Tide Water also plans to build a 24,000-bbl. hydrodesulfurization unit, a new gas plant, and expand its fluid catalytic-cracking facilities at Avon.

Esso's new unit marks the return of coking to East Coast refinery operations after many years' absence. No coking has been practiced in the area since the old chamber-type units were operated many years ago. The Esso unit is the first of three which are scheduled for the East Coast. More are in the planning stage. The country's first fluid coker was at Carter Oil Co.'s Billings, Mont., refinery.

Esso also placed on stream last month two new pipe stills, new Hydroforming and Hydrofining facilities, and revamped the fluid catalytic-cracking unit here. The 3,000-bbl. per day Hydroformer is of new design, employing a platinum-type catalyst in a fixed bed.

The three new Hydrofiners will be capable of processing 12,000 bbl. per day of light virgin, light coker, and heavy cracked naphtha; 3,000 bbl. of heavy virgin naphtha; and 5,000 bbl. of heavy cracked heating oil.

Industry Briefs

WASHINGTON.—Esso Shipping Co. has signed a contract with the Maritime Administration for trade in of five T2 tankers as credit on construction of two 18.3-knot supertankers. Oil companies now are building six tankers under the trade-in-and-build program. Cities Service Oil Co. is building three, and The Texas Co. is building one.

WASHINGTON.—Orme Lewis, assistant secretary for public land management of the Department of the Interior, has resigned to rejoin his law partnership in Phoenix, Ariz. Lewis, who joined the department 2½ years ago, figured prominently in the federal Government's recent leasing of lands off the coast of Louisiana *(The Oil and Gas Journal, July 18, page 62).*

NEW YORK CITY.—More than 70 American industrial companies and a group of United States and foreign government agencies will participate in New York's first peacetime atomic energy exposition. The show will be held October 20 through November 3 at the Carnegie Endowment International Center here. The exhibit will be conducted by Atomic Industrial Forum, Inc., New York City.

NEW YORK.—Dome Gas & Oil Corp. has completed its 1 Herdman test in New York's Catskill Mountain region. The well tested 100,000 cu. ft. daily on open flow from shale at 5,360 ft. It was completed at 6,400 ft. The company plans to start a second well to the west of 1 Herdman within 30 days. It has leases on about 25,000 acres in Ulster, Greene, and Delaware counties. Transcontinental Gas Pipe Line Corp. has an option on the gas if commercial production is developed *(The Oil and Gas Journal, December 27, 1954, page 108).*

MIDLAND, Tex. — Devon Leduc Oils, Ltd., has completed arrangements for the purchase of 432,000 acres of uranium lands in northwestern New Mexico from Sol Kelly. The land is checkerboarded over an area covering 21,900 sq. miles in the Laguna-Grants section of the Colorado Plateau.

DALLAS, Tex.—The American Petroleum Institute has published its first official volume of a specification covering oil-field materials, as distinguished from equipment. The publication of the Second Edition, Standard 10A, "Specification for Oil Well Cements," was announced by the A.P.I.'s Division of Production.

Firms Tackle Tar Sands

Can-Amera, Royalite join in first private venture to tap oil resources of Alberta's fabled Athabasca deposits

CALGARY.—Two Calgary companies have joined in the first private venture to tap the fabulous oil resources of Alberta's Athabasca tar sands on a commercial scale.

Can-Amera Oil Sands Development, Ltd., and Royalite Oil Co. announced they planned to proceed immediately with a development program. Tests, they said, show oil can be produced from the saturated sands at a price competitive with crude oil.

The firms plan to use the Coulson process of extracting oil from the sand by centrifugal pressure. They gave no details of their planned development program but conservative estimates have put the capital outlay at $60 million.

This investment would provide a plant and pipeline to Edmonton capable of handling a minimum economic production of 25,000 bbl. daily. The 300-mile, 8-in. pipeline would cost $15,600,000; fluid coking equipment $8 million more, and the balance would provide extraction units to be built by the De Laval Corp.

Can-Amera has held a licensing option from the provincial government on 6,000 acres of tar sands since 1953. It conducted a test run of the Coulson process in 1954 which was successful.

Stakes are high . . . If Can-Amera and Royalite obtain commercial production from the Athabasca, it will solve a problem which has defied the Alberta government and world oil men for nearly a half century.

The Athabasca sands extend for more than 100 miles along the Athabasca River and its tributaries in northeastern Alberta. The gummy mass of sand is estimated to contain from 100 to 300 billion barrels of oil. The sand forms a layer up to 200 ft. thick and outcrops over at least 3,000 sq. miles.

The sand bed may contain as much as 100 million barrels of oil per square mile and the entire area represents the world's largest untapped oil reservoir.

Big Problem . . . But the Athabasca has frustrated oil men for years because an economical method has not been found to extract the molasses-like oil from the sand.

The Alberta government for years has sought a solution to the extraction problem. It has operated pilot plants

at Bitumount, on the bank of the Athabasca River, where the sand is only 8 ft. below the surface. The plant used a hot-water process to get the oil out of the sand. It produced a high-quality oil. The cost involved, however, eliminated the scheme as a commercial venture.

The idea . . . In 1951 Gordon Coulson, a Calgary building contractor, as a hobby started toying with possibilities of extracting the oil. He proceeded from a theory that the world is a huge centrifuge.

In millions of years of spinning it has separated by densities the oil, water, and gas in natural pools. He figured that nature in simplicity had put the oil and sands together so there must be a simple way of separating them.

Coulson decided if the world could separate these components by centrifugal force, he would speed up the process. He took an ordinary glass jar and filled it with oil sand, water, and kerosine. He then spun the jar in an ordinary spin-dry washing machine.

The result amazed him. The kerosine took on a lot of the oil. The water was at the second level with the sand beneath that. After exhaustive tests, Coulson patented the process in 1953. He formed Can-Amera and interested Mill Creek Petroleums in supplying capital to build more equipment and further testing.

The process . . . Coulson's present extracting unit is a series of three centrifugal separating machines. An entire unit capable of producing about 3,000 bbl. daily would fit comfortably in the average living room.

First step requires mixing the oil sand with a diluent such as kerosine. This mixture is fed into the first separator which removes easily 70 to 80 per cent of the oil.

Residue sand from this operation is mixed with water and fed into a second unit. Centrifugal pressure flings a large portion of the remaining oil from the sand. At this stage 90 per cent of the oil has been removed from the sand, which then is discarded.

The third separator is fed at the top with oil and diluent from the first operation and at the bottom with oil and water from the second unit. This last whirling removes the water and most of the solids leaving a mixture of oil and diluent which is ready for refining.

Coulson claims tests have shown his process removes 90 per cent of the oil from the sand. Government restrictions on developing the Athabasca sands require removal of only 65 per cent of the oil.

The Coulson process does not call for a large central plant. Small, compact units are planned. They can be mobile, permitting them to be taken to the sand rather than transporting the sand to a central plant. This also eliminates the problem of disposal of waste sand. It can be deposited into the stripped area.

Still big problems . . . Even if the new group has conquered the oil-extraction problem, experts point out they face a tremendous problem refining the crude into products.

Athabasca oil has a sulfur content averaging 5 per cent by weight. This will require special and costly processing. But it also may represent a large potential reserve of sulfur. Another problem is the presence of heavy minerals such as silver, nickel, and vanadium. They may also be processing headaches.

But the potential stakes in the Athabasca are so tremendous, they present a continual challenge to both the producer and the refinery.

Pipeline Battle

Three Canadian firms seek Sundre-Westward Ho line

CALGARY.—The fight to see who is going to move oil from the Sundre-Westward Ho field was increased by one participant last week.

Pembina Pipe Lines, Ltd., became the third member in the tiff when it filed an application for a pipeline with Alberta's Petroleum and Natural Gas Conservation Board.

Cremona Pipeline Co., Ltd., principally owned by Home Oil Co. and Federated Petroleums, Ltd., and Rangeland Pipeline Co., a subsidiary of Hudson's Bay Oil & Gas Co., had filed previously. Hudson's Bay owns about 85 per cent of the field's proved reserves of 9,600,000 bbl.

Here are the applications now before the board:

. . . **Pembina Pipe Lines, Ltd.,** plans to extend its present line from Pembina field to the Sundre-Westward Ho area and to move the crude oil to Edmonton.

. . . **Rangeland Pipeline Co.** proposes to build a line into the Rimbey area where it would hook up with a proposed extension of Texaco Exploration Co.'s line for movement into Edmonton.

. . . **Cremona Pipeline Co.** plans to build its line into Calgary to serve the refineries there.

At the first hearings last week, R. R. McDaniel, of McDaniel Consultants, Ltd., said the probable reserves of the area are 96,000,000 bbl. Alex Clark, vice president of Home-Federated Petroleums, said the Sundre-Westward Ho area is 65 miles long and 20 miles wide and has an area of 1,300 sq. miles.

Oil Pays Off for Alberta

EDMONTON. — The petroleum industry has enriched the province of Alberta by $405,438,623 since April 1, 1946.

The information was released in a report issued by the Alberta Department of Mines and Minerals and included $39,103,312 collected during April, May, and June of this year.

Crown reserve lease sales brought $156,485,155 for 342,224 acres to top the list of revenue winners. Royalties from petroleum and natural-gas production were in second place with $80,703,995 placed in the coffers.

Amurex to Acquire Ponder

CALGARY.—Amurex Oil Co. will acquire most of the assets of Ponder Oils, Ltd., if the stockholders of the two firms approve the action.

The deal would also include all the assets of Ponder Oils, Inc., and Devon Drilling Co., Ltd., subsidiaries of Ponder.

Total assets of Amurex after acquiring Ponder would be about $10,000,000. Income from oil production, after payment of royalties, would be about $800,000 yearly.

The board of directors of Amurex is made up of representatives of Ashland Oil & Refining Co., Murphy Corp., and A. G. Becker Co. W. L. Falconer and Oliver H. Payne, present directors of Ponder, will join the Amurex board.

Tide Water Orthoflow Unit Under Way

Reinforcing rods are fitted into the octagonal base for the Orthoflow catalytic converter column, one of the first units going up at Tide Water Associated Oil Co.'s 130,000-bbl. Delaware refinery, south of Wilmington. After the rods are in place, concrete will be poured into the form to provide a foundation for the 250-ft. tower. The steel shells in the background are sections of the converter. The giant catalytic cracker will have a capacity of 102,000 bbl. daily.

Canadian Briefs

REGINA.—Saskatchewan Power Corp. will begin work soon on electrical transmission lines to serve more than 120 oil wells in the Saskatchewan fields of Coleville, Cantuar, Success, and Fosterton.

OTTAWA. — More than 3,500,000 people of Canada's 15,000,000 population are now using natural gas, according to the 1955 edition of the Canadian Gas Utilities Directory.

FORT WILLIAM, Ont.—Husky Oil & Refining, Ltd., has completed a $1,000,000 expansion at its refinery here. The company increased the capacity of the plant from 1,800 to 4,000 bbl. daily and added a Platformer and Diesulforming unit.

VANCOUVER, B. C.—Trans Mountain Oil Pipe Line Co. showed a $1,998,327 profit for the first 6 months of 1955. Deliveries for the first half of the year averaged 73,779 bbl. daily compared with 34,206 bbl. during the same period in 1954. With completion of its extension to Shell Oil Co.'s refinery at Anacortes, Wash., throughput is expected to reach 100,000 bbl. daily by the end of the year.

CALGARY.—Socony - Vacuum Oil Co. of Canada, Ltd., has changed its name to Mobil Oil of Canada, Ltd. H. R. Moorman, executive vice president and manager of the firm, also said that the company's building name has been changed from the Barron Building to Mobil Oil Building.

REGINA.—Unitization of the J-2-A zone of Dollard oil field is being sought by Tide Water Associated Oil Co. and Frontier Refining Co. Unitization plans, plus Tide Water's application for a water flood in Dollard, will be discussed at a public hearing here August 9 before the Saskatchewan Oil and Gas Conservation Board.

Atomic Research Pushed

Socony Mobil joins in first industrial nuclear reactor; also plans own atomic lab to study applications to oil

NEW YORK.—Socony Mobil Oil Co., Inc., has joined with seven other American industrial firms in a project to build and operate the first nuclear reactor owned and used by private industry for research.

The reactor will be built somewhere in the New York area. Location has not yet been selected.

In addition to the joint effort, Socony Mobil disclosed last week it will build its own nuclear research center. The oil company will begin a sweeping new program aimed at investigation of new energy sources and improvement of oil refining and oil products.

The nuclear reactor will be built by AMF Atomics, Inc., a subsidiary of American Machine & Foundry Co., headed by Gen. Walter Bedell Smith. The facility will be called Industrial Reactor Laboratories and will be located on a 250-acre tract within commuting distance of New York City.

Cost of the reactor is estimated at from $1,500,000 to $2,000,000 with annual operating expenses of the laboratory put at $250,000.

Options have been taken on two sites in New Jersey and New York within 50 miles of the city. Final selection of the site is subject to approval of the Atomic Energy Commission.

The laboratories actually will be operated by a university, as yet unnamed. But the research policy will be set by a board of directors composed of representatives of each of the eight participating companies. The laboratories will be owned by a corporation in which each of the eight has an equal interest.

The eight participating companies are AMF Atomics, Socony Mobil, American Tobacco Co., Continental Can Co., Corning Glass Works, International Nickel Co., Charles Pfizer & Co., Inc., and United States Rubber Co.

Socony's center . . . The planned Socony center will be owned and operated by Socony Mobil Research Laboratories. It will include a Van De Graaf accelerator and associated facilities to provide high-energy electrons, protons, X-rays, and neutrons for research in nuclear physics and radiation chemistry.

The Van De Graaf accelerator is one of the family of so-called atom smashers. The device can produce a flux of neutrons as great as hundreds of grams of radium would produce naturally.

In addition to the accelerator, Socony's center will have "hot" laboratories equipped for the manipulation of fission-waste radioisotopes and secondary radioactive sources such as antimony-124, cobalt-60, and iron-59. The latter will be activated by irradiation in the nuclear reactor.

The center also will contain a "counting" laboratory for assaying radioactive materials, general research laboratories, offices, and facilities to protect the health of staff members.

Like the joint-venture reactor, it will be built at an undisclosed location. Work on both is expected to begin in early fall. Both should be in operation within a year, Socony Mobil said last week.

Socony has been using a Van De Graaf accelerator for more than 2 years at the company's field research laboratories in Dallas, Tex. It has been used in research on problems in exploration and production. Another was installed last February in the Tulsa laboratories of Well Surveys, Inc., for research in well logging *(The Oil and Gas Journal, February 22, 1954, page 109)*.

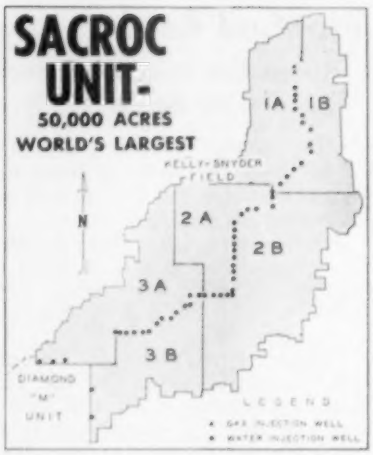
What Socony expects . . . William M. Holaday, Socony Mobil's research director, said last week the new center will allow the company greatly to expand the scope of its nuclear research and conduct all types of nuclear physics and radiation chemistry investigations.

Holaday pointed out that nuclear processes produce enormous quantities of energy and promise to be "the most prolific source of energy mankind has ever known." In addition, the "entirely different nature of the energy" involved, a new field of physics and chemistry is opening up.

The research director said irradiation at high energies induces "unique chemical changes and opens the door to new types of processes and products." He said many petroleum products of the future may be made by these energy conversion methods.

The cracking of hydrocarbons to produce high-octane gasoline could be carried out by using the heat from a nuclear reactor together with its radiation more efficiently than using today's conventional thermal and catalytic processes.

Socony Mobil's researchers pointed out also that hydrocarbon molecules can be crosslinked by nuclear radiation, vastly changing the properties of petroleum products.



Flood Successful

Water proves better than gas injection in SACROC

SNYDER, Tex.—SACROC Unit, the biggest unitized secondary-recovery project in the world, has discovered in short order that water flooding is better than gas injection for Kelly-Snyder field's prolific Canyon Reef pay.

The unit asked the Texas Railroad Commission last week for permission to start water flooding in the north end where it has been injecting gas in the Scurry County field.

H. W. Elliott, Jr., chief engineer for SACROC, said the water flood, begun last September, has lived up to all expectations.

By June 1 of this year, SACROC had pumped 35,203,375 bbl. of water into the Canyon Reef through 53 input wells. The producing gas-oil ratio in the flood area was cut from 1,260:1 in July 1954 to 1,072:1 last January.

Bottom-hole pressure increased 15 psi. in that area. It dropped 34 psi. where gas is being injected.

The northern part of the unit has 105 wells on 4,110 acres. Elliott estimated oil in place to be 245,000,000 bbl. of stock tank oil at saturation pressure.

The SACROC flood uses a line of input wells extending north-south along the crest of the structure. Most recent estimates place primary recovery at 667,000,000 bbl. and secondary recovery at 795,000,000 bbl.

Elliott said SACROC wants to add two more inputs on the north end of the line to flood the area now taking gas. The wells are producers 17A-1 and 17-5. The entire reef section would be exposed to water injection.

Plans are to inject 16,000 bbl. of water a day through the two wells. This, Elliott said, should be more than enough to maintain pressure and balance reservoir withdrawals in the area.

Record Test Starts

Deepest wildcat in Texas tidelands is 20 miles out

PORT ARANSAS.—"Mr. Gus," the big mobile drilling barge of Glasscock Drilling Co., was making hole rapidly last week at the deepest wildcat ever drilled in the Texas tidelands.

The test is being drilled in 83 ft. of water 20 miles due east of Port Aransas for the Atlantic Refining Co. and Tide Water Associated Oil Co. Location is in Block 726, a 5,582.96-acre tract of the federally owned portion of the tidelands.

Projected total depth of the venture is about 9,000 ft. Early last week operator had landed 13⅜-in. casing at 1,823 ft. and was drilling ahead.

The Atlantic-Tide Water wildcat is the first step by the two firms to evaluate a tract totaling 25,388 acres for which they paid bonuses totaling about $6,188,000 at the sale of federal leases off Texas last November.

Block 726 is one of five adjoining blocks making up the tract. The Atlantic-Tide Water combine paid $3,650,017 for Block 726 and $2,250,017 for Block 725. Remainder of the investment went in smaller bonuses for Block 727, Block 716, and the east half of Block 718.

Nearest production to the test is at Mustang Island and Fulton Beach—both in coastal waters roughly 20 miles shoreward. However, exploration by the two companies indicates a salt dome underlies the high-priced acreage and the present wildcat should encounter the salt no deeper than 9,000 ft.

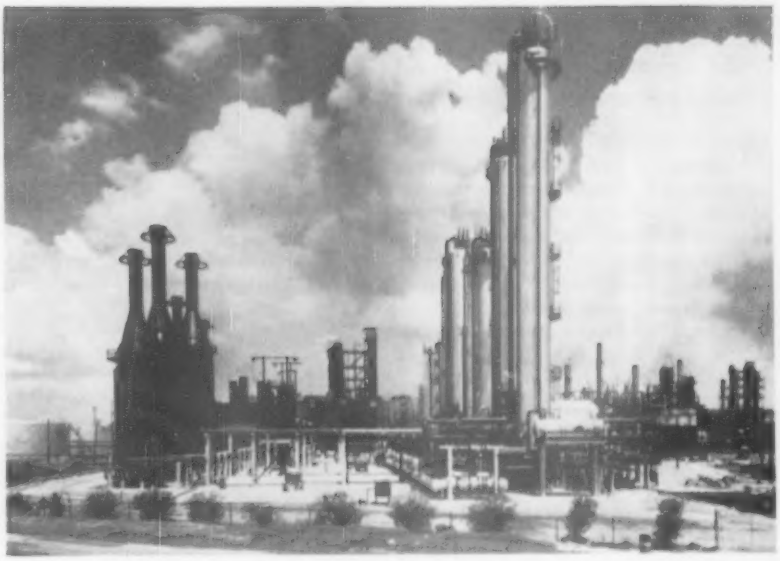
This is the first hole off the Texas coast for "Mr. Gus." The big barge moved to the Atlantic-Tide Water project from operations for Shell Oil Co. in the Louisiana tidelands off the mouth of the Mississippi.

Gas Found in "Dry Hole"

BASIN, Wyo.—A surprise find of high-pressure sweet gas from an abandoned well may lead to testing of all Phosphoria wells in the Muddy sand of the Manderson field near here.

Mobil Producing Co. brought in the retested well in the Muddy at 6,000 ft. in the northern part of the field. Production was estimated at 9,000,000 cu. ft. in 3 hours. General Petroleum had drilled the well, 3 miles west of the Mabel West discovery, to the Phosphoria with no production and abandoned it at 8,000 ft.

An oil and gas discovery in the Muddy in South Manderson by L. J. Peterson led to the Mobil test.



World's Largest Platformer on Stream

This 29,000-bbl. Platformer at Gulf Oil Corp.'s Port Arthur refinery is the fourth catalytic reformer placed on stream by Gulf within the past year. Unlike the other units erected at the Philadelphia, Toledo, and Cincinnati refineries, the unit which recently went on stream at Port Arthur will produce blending stocks for aviation gasoline as well as for automotive fuels. Designed by Universal Oil Products Co., the Platformer is the largest of its type yet built. First charge of catalyst cost approximately $800,000.

U. S. Tanker Skid Continues

Private fleet registers decline of 338,000 deadweight tons during first half of 1955; further drop forecast

WASHINGTON. — The ocean-going tanker fleet flying the U. S. flag continued its steady decline the first half of 1955, and the outlook is for a further tonnage reduction the second half.

The fleet registered a drop of 338,000 deadweight tons the first 6 months despite increased shipments of crude oil and products. Oil companies and other private carriers have only 200,000 deadweight tons on order, pointing to a continued net drop as present tankers become less competitive.

A report by the American Merchant Marine Institute cites two factors which have contributed to the decline:

. . . **Foreign competition** is increasing.

. . . **Government-owned tankers** continue to be used by the Military Sea Transport Service.

The downward trend is expected to see the United States lose within a year the world tanker leadership forced upon it by World War II *(The Oil and Gas Journal, July 4, page 64)*.

At the end of the war America had more tanker capacity than the rest of the world combined. This dropped to 23.3 per cent of the world total December 31, according to a survey by Sun Oil Co., which listed U. S. capacity at 8,446,200 tons.

Several tankers removed . . . During the first half of this year, only one small coastal tanker was added to the private fleet. At the same time 24 were removed.

Eleven were lost when they were returned to the Maritime Administration. Of these, five were traded in to be replaced by more modern vessels. Six were forfeited to the Government. Eight tankers were sold or transferred abroad. Three were sold for scrap, one was transferred to the inland service, and one overage tanker was converted to a bulk dry cargo vessel.

The biggest drop in the fleet was in vessels engaged in U. S. foreign trade. Tonnage slumped 36.8 per cent during the past 2 years to 1,200,000 deadweight tons by mid-1955. Foreign-to-foreign trade vessels skidded even further. This figure plummeted from a million tons for the 1949-53 period to some 200,000 tons July 1, 1955.

Tankers in domestic trade, however, increased 7½ per cent over July 1954. Inactive capacity of 700,000 tons July 1 was 50 per cent below a year ago.

Imports Cut Asked

27 senators demand level be returned to 1954 ratio

WASHINGTON.—Twenty-seven senators, 13 Democrats, and 14 Republicans are demanding that Defense Mobilizer Arthur S. Flemming cut imports of foreign oil to the level recommended by the President's cabinet committee and Congress.

The senators, in a letter to Flemming, said the ratio of imports to domestic production has been rising at an alarming rate.

"For the first 6 months of 1955," they wrote, "this ratio was substantially above that of 1954, the level recommended by the President's cabinet committee on energy supply and resources policy."

They declared imports of foreign oil had reached the point that they constitute a threat to national security and added that responsibility for correcting the situation lay with his office.

The cabinet committee said that crude imports should not significally exceed 10.34 per cent of domestic production, and that imports of residual fuel oil should not significantly exceed 6.24 per cent of domestic production.

Figures for the first 6 months of the year and prospects for the second half indicate crude imports will be 11.05 per cent and residual imports 6.72 per cent of United States production *(The Oil and Gas Journal, July 25, pages 126-128).*

The question before the Office of Defense Mobilization is whether this significantly exceeds the recommended level. The senators think so.

Conoco Shifts Offices

CORPUS CHRISTI. — Continental Oil Co. has expanded its Corpus Christi offices and transferred several key men here from San Antonio in a move to centralize its South Texas exploration and production operations.

The offices here will be headquarters for the company's Texas - Gulf Coast production division formerly centered in San Antonio and for a new exploration division consolidating the work of the old Corpus Christi and San Antonio offices. Continental has 475 producing wells in this area and is planning an expanded exploration campaign.

Texaco Pays Big Judgment

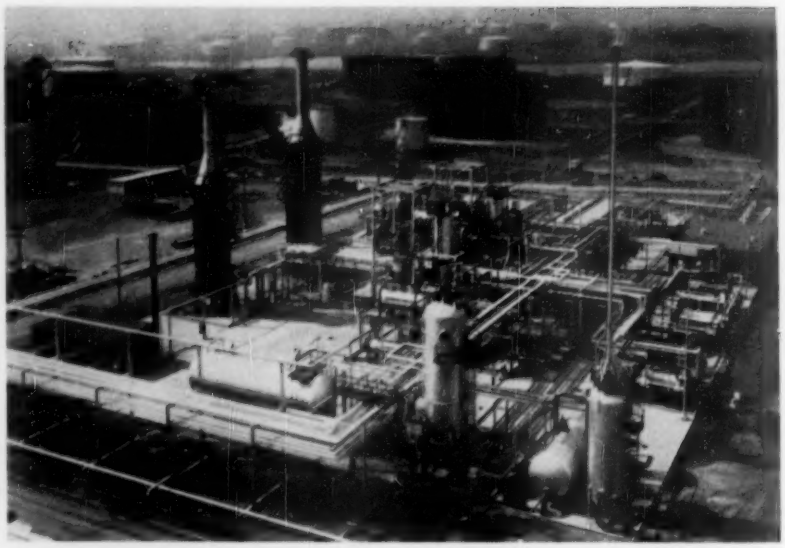
AUSTIN, Tex.—The Texas Co. last week paid off a $1,398,788 judgment to the State of Texas.

The huge payment represented profit Texaco had made plus interest during 21 years of production from a 4,000-acre oil and gas lease which now has 42 producing wells on the Duval County ranch in South Texas.

The Texas Supreme Court ruled in April that the state had been unlawfully dispossessed of the mineral rights May 24, 1922, when Duval County Ranch Co. leased the lands to R. E. Breeding, who later conveyed them to Texaco.

The state had argued that the ranch company owned only the surface acreage under provisions of the 1919 Relinquishing Act *(The Oil and Gas Journal, April 11, page 86).*

Texaco, of course, loses income from future production from the tract as well as the $1,398,788. John Ben Shepperd, Texas attorney general, estimated that the state's permanent school fund would benefit ultimately by an additional $9,000,000.



Esso Hydrofiners Upgrade Fuel Oils, Naphthas

Esso Standard Oil Co. has gone in for upgrading its gasolines and fuel oils at its Bayway refinery, Linden, N. J., in a big way. The company recently placed these two Hydrofiners on stream. The units, which were developed by Esso Research and Engineering, use a catalytic hydrogenation process to upgrade products. The larger of the units charges 19,520 bbl. daily of 24°-gravity cracked heating oil. The process improves the oil's odor and color and increases its storage stability. The second unit treats 7,640 bbl. daily of 44°-gravity cracked naphtha. Hydrofining the naphtha improves engine cleanliness and removes sulfur and other impurities.

Gulf to Increase Storage

AUSTIN.—Gulf Oil Corp. will add another 150,000 bbl. of underground storage capacity at its Fannett field storage center in Jefferson County. The Gulf Coast site will be used to store products from Gulf's Port Arthur, Tex., refinery.

The company has asked the Texas Railroad Commission for permission to drill a storage well into the Fannett salt dome underlying its E. Thomas et al lease.

R. F. Thomas, Gulf engineer, said that Gulf expects to top the cap rock at 780 ft. and the salt at about 2,113 ft.

Thomas said the company expects to recovery 98 per cent of products on first-cycle reproduction from storage and to better this percentage on subsequent cycles.

Union Merger Bid Expected

DENVER.—The A.F.L. International Chemicals Workers Union may be invited this week to merge with the C.I.O. Oil, Chemical, and Atomic Workers International Union.

The bid is expected to be made at the C.I.O. union's convention opening August 8 in St. Louis.

An alliance with the 70,000-member chemical group would give O.C.A.W. a total membership of approximately 290,000.

It would be a step forward in O.C.A.W. President O. A. (Jack) Knight's announced intention of bringing under his jurisdiction 1,000,000 additional workers in the oil and chemical fields who are not now members of the union.

The 70,000 chemical workers are mostly scattered throughout the East, with the heaviest concentration in the Great Lakes area. However, none is reported employed by Du Pont, largest company in the chemical industry scheduled for initial organizing attempts by O.C.A.W.

New Survey Ordered

Clareton study to determine best recovery possibilities

CHEYENNE, Wyo. — Another engineering study of the Greater Clareton field in Wyoming, the second this year, has been ordered by the State Oil and Gas Commission.

The new survey will determine whether water injection or repressuring should be used in lengthening productive life of the field.

An earlier study made by Core Laboratories, Inc., singled out wells in the field producing in excess of 5,000 cu. ft. of gas per barrel of oil. W. L. Horner, Core vice president in charge of reservoir engineering, reported of the 608 wells checked, 135 were found to be excessive producers.

The commission ordered all over-the-limit gassers shut in. The order, scheduled to expire July 31, has been extended until August 20. Commission members explained this action was taken to allow an unnamed gas company to decide if it will construct a gas-processing plant in the field at a cost of several million dollars. A decision is expected by August 13.

Horace Thomas, state geologist, said the company's interest in the field was aroused when the Core Laboratories survey indicated a larger gas potential than expected. Thomas added wider conservation practices could increase oil production at least 20 per cent, representing an extra $36 million income.

The geologist reported the unidentified gas firm already has signed up operators for the delivery of 22,500,000 cu. ft. of gas daily. It would be processed at a plant near Newcastle and the residue gas marketed through a system yet to be developed.

Voss Oil Co. recently announced it had purchased a processing plant in Oklahoma and would move the unit to the Clareton field. The Greater Clareton Producers Committee, headed by independent James P. Sloss of Denver, also is considering constructing one or more plants in the field.

Gas Bill Held Over

But it now has chance of careful study in Senate

WASHINGTON. — Congressional backers of the Harris bill exempting natural-gas producers from federal regulation hope the measure will be considered by the Senate next year under more leisurely circumstances.

The House passed the bill, 209 to 203, in a hectic session a few days before final adjournment. Senate consideration of the bill later was postponed until next year when at least three senators threatened privately to stage a filibuster against it.

Supporters of the Harris bill now hope the Senate will consider it on its merits in 1956. Unless Senate leaders delay taking up the bill until late in the session, chances of a group "talking it to death" are considered remote. The Senate interstate commerce committee already has approved a bill identical to the Harris bill.

The split action on the bill leaves the natural-gas industry in an uncertain position for several months on expansion plans and new contracts.

Drilling Barge Makes Long Voyage

Shortly after its launching by Levingston Shipbuilding Co. at Orange, Tex., this submersible drilling barge was towed into the Gulf of Mexico en route to South America. The vessel soon will go to work in water 20 ft. deep off the coast of Trinidad, where Southeastern Caribbean Drilling Co., C.A., will drill for The Texas Co. The barge will be used in exploring submerged lands in the Gulf of Paria, between Trinidad and Venezuela. Much of the area close to shore already has been explored by directional holes drilled from the coast. The barge is 200 ft. long and 54 ft. wide. In addition to drilling equipment, it contains quarters for 14 men.

Pipeline Briefs

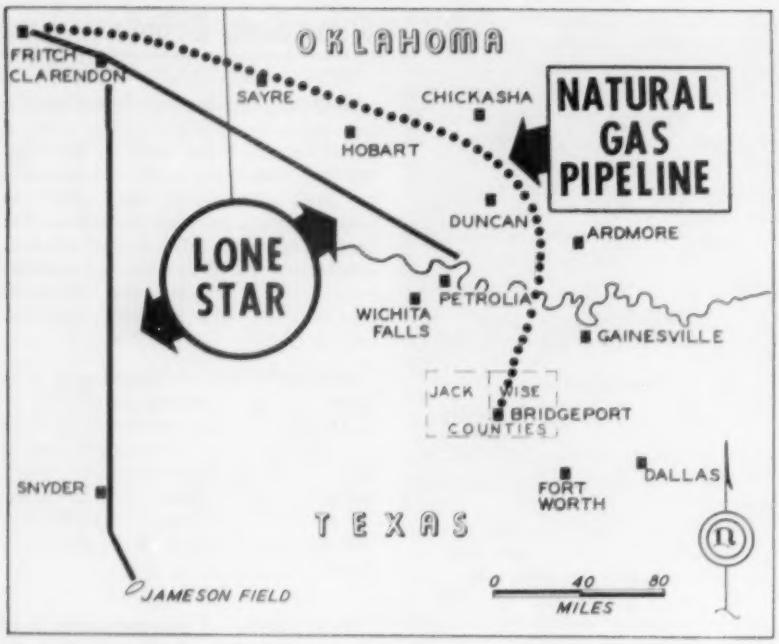
WINK, Tex.—Pasotex Pipe Line Co. has begun construction on 70 miles of 20-in. crude-oil line between here and El Paso. The line will be substituted for parts of two 8-in. lines which are now in service between the towns. The firm, a Standard Oil Co. of California subsidiary, will eventually expand the system to 220,000 bbl. daily *(The Oil and Gas Journal, July 18, page 69).*

WASHINGTON.—Washington Gas Light Co. has received permission of the Federal Power Commission to build 11 miles of 24-in. natural-gas line in the District of Columbia and Prince Georges County, Maryland. The project will cost more than $2,000,000 and will include a crossing of the Anacostia River.

HOUSTON.—Transcontinental Gas Pipe Line Corp. will begin adding 27 miles of loop line to its natural-gas system in Louisiana, Georgia, North Carolina, Virginia, and Maryland. The company has received temporary Federal Power Commission approval for the construction. The project will cost $3,426,000 and enable Transco to deliver an additional 10,000 M.c.f. of natural gas daily. The gas will be delivered to Marcus Hook, Pa., where Sun Oil Co. is building an ammonia plant at its refinery there.

WASHINGTON.—Principal pipeline carriers delivering crude oil in Michigan and Ohio have reduced rates about 2 cents per barrel, according to joint tariffs filed with the Interstate Commerce Commission. The rates are effective this month and apply to delivery points at Canton, Bayshore, Heath, and Findlay, Ohio; Earhart Station and Crystal Station, Mich.; and Rock Island, Ill.

EL PASO, Tex. — Construction has begun on two pump stations on the products lines being built by Southern Pipe Lines, Inc., from here to Phoenix, Ariz., and from Los Angeles to Phoenix. Robert M. McKee, Inc., El Paso, is installing two centrifugal pumps driven by 300-hp. electric motors here. J. A. McNeil Construction Co., Alhambra, Calif., has the contract for the Watson, Calif., station, which will have three 300-hp. pumps. Bids have been asked on three 900-hp. units at Colton, Calif. Three spreads are at work on the $30 million line and two others will start this month *(The Oil and Gas Journal, June 27, pages 67-68).*



Gas Fight Near Climax

The question: Can Lone Star keep Natural from offering more than the going field price? Answer due next month

Robert J. Enright

DALLAS.—A ticklish issue—whether one big pipeline company can invade another's area of supply and bid up gas prices at the wellhead—is heading for a September 12 showdown before the Federal Power Commission.

The commission recently agreed to hear on September 12 Lone Star Gas Co.'s request for authority to build a 230-mile pipeline in Texas and Oklahoma to make available 100,000,000 cu. ft. of gas per day at Fritch, Tex. The gas would then be sold to Natural Gas Pipeline Co. of America, the other principal in the battle.

Crux of the issue is a request by Natural to build a line from the Texas Panhandle through southern Oklahoma swinging south into gas-producing areas of Jack and Wise counties, Texas. The 350-mile, 26 and 20-in. transmission line would pull the firm out of a squeeze.

A combination of increased demand and its own dwindling natural-gas supplies in the Texas Panhandle has placed Natural Gas in short supply. It is 80,000,000 cu. ft. per day short now. It estimates by 1974 this shortage will climb to 240,000,000 cu. ft. daily.

What Natural wants . . . So far Natural has made up the shortage by buying gas from other big producers under long-term contracts and on the spot market. The proposed line would take 78,000,000 cu. ft. daily from Wise and Jack counties. Extra supplies would then be added from gas fields in southern Oklahoma through which it would travel. This supply would be delivered into Natural's main trunk line at Fritch in the Panhandle.

Natural Gas would buy the new Texas gas from Oil Drilling, Inc., which claims it has reserves under contract totaling 700 billion cubic feet. Under a complicated pricing agreement Natural would pay about 15 cents per M.c.f. An escalation clause provides a 1 cent increase every 5 years for the 20-year contract period. Estimated cost of gas delivered to Fritch would be 35.6 cents per M.c.f.

Cost of the line was put at $32,070,000—$28,487,000 for the main line and $3,583,000 for the gathering system and connecting adjustments at Fritch.

Why Lone Star objects . . . Lone Star Gas opposed the proposed line and was joined by Oklahoma Natural Gas Co., State Fuel Supply Co. of Oklahoma, and Upham Gas Co.

Lone Star objected to Natural entering the Wise-Jack producing area and offering 15 cents a M.c.f. for gas. Lone Star has been the chief purchaser in the area where the going rate has been 11 cents a M.c.f.

Lone Star claimed if Natural were allowed to boost the field price it would force Lone Star to increase the price it pays for gas all over North Texas and southern Oklahoma. It estimated the total cost would be $13 million a year.

But Natural and its producer supporters were dealt a heavy blow when intervenor briefs were filed. FPC staff counsel recommended to the examiner that the Natural application be denied.

The FPC counsel based his recommendation on two objections: No evidence was presented that the Natural price was "just and reasonable" and Oil Drilling did not prove its ability to supply gas to Natural Gas Pipeline nor finance its part of the project.

Some observers feel this move may be a tipoff that Natural's request will be turned down.

Unusual offer . . . Whatever the outcome, Lone Star has made an unusual countermove to supply gas to Natural at Fritch cheaper than Natural can bring it in over the proposed pipeline. It has asked FPC approval of the plan which will involve building one and possibly two pipelines.

This application calls for the company to lay a 230-mile, 26 and 22-in. gas line from a connection with its system in Cotton County, Oklahoma, to Fritch. The line would cost $18,749,600 and would supply Natural initially with up to 100,000,000 cu. ft. a day.

The gas would be delivered to Natural at Fritch for 20.6 cents an M.c.f. at a 100 per cent load factor, 21.5 cents at 90 per cent load, and 22.5 cents at 80 per cent load. This is roughly 60 per cent of what the Wise County gas would cost Natural.

Most of the gas, Lone Star says, would come from southern Oklahoma fields, although the entire Lone Star system would stand behind the proposed 20-year contract.

Also, Lone Star told FPC, it is preparing an application and will submit it soon, to lay a second line. It will go from Jameson field of Coke County, West Texas, 210 miles to the north to connect with the Cotton County-Fritch line near Clarendon in Donley County.

This line would deliver another 100,000,000 cu. ft. of West Texas gas to Natural as a second stage of the project when Natural indicates a need for still more gas.

Lone Star says if Natural should turn down this offered supply, it still can develop a market for the gas among other purchasers in the Panhandle.

Price Controls Eased

New competition is factor in Colombia's dropping set prices; Ecuador, Peru raise ceilings, retain controls

COUNTRIES along the western coast of South America apparently are easing rigid restrictions on products sold for internal consumption.

Colombia is the latest government to relax controls. It has removed arbitrary prices on most important products. In doing so, Colombia went further than Ecuador and Peru. Price ceilings in these countries were recentiy raised for some products. But price controls themselves remained in effect.

In Colombia, however, a government decree freed prices on aviation and motor gasolines, special white-fuel oil, asphalt paint, and asphalt. The decree applies whether products are produced locally or imported.

Shell in picture . . . The removal of controls followed Shell's entry into Colombia as a strong marketer. Previously, marketing had been virtually dominated by Esso Colombiana, S.A., a subsidiary of International Petroleum Co., Ltd., in turn a subsidiary of Standard Oil Co. (N. J.).

The oil companies requested the removal of price controls on the grounds an artificial structure would hinder the development of the oil industry in the country and were unnecessary because of increased competition. The controls were placed in effect before World War II. As a gesture of good faith, both Shell and Intercol reduced the price of motor gasoline by 0.4 cent a gallon when price restrictions were removed May 31.

Gasoline is Colombia's most important petroleum product. Consumption last year was about 16,500 bbl. daily, up 23.7 per cent over the preceding year. It accounted for about 47 per cent of the total domestic consumption of some 35,000 bbl. daily, which as a whole was up 19.5 per cent over 1953.

I.P.C. entered the Colombian picture as an integrated operator when it acquired ownership of Tropical Oil Co. shortly after World War I. Tropical Oil owned the de Mares concession, transportation facilities, and the Barrancabermeja refinery, the largest processing installation in the country.

de Mares concession . . . The de Mares concession was a 30-year grant which expired on August 25, 1951. At that time, the concession, refinery, and other permanent facilities reverted to the government. As a result, Tropical Oil was dissolved. Esso Colombiana, S.A., took over marketing and transportation activities. Other operations, including exploration and development of other concession areas, became the responsibility of another subsidiary, International Petroleum (Colombia), Ltd. These operations included running the refinery on a 10-year lease from the government on a rental and throughput charge. The refinery now has a capacity of 37,250 bbl. daily.

Other countries . . . In Ecuador, the government raised the basic selling price of kerosine by ¾ cent a gallon, diesel oil 2½ cents a gallon, and fuel oil 1¼ cents a gallon. The price of gasoline was not increased. But Anglo-Ecuadorian Oilfields, Ltd., agreed to import up to 340,000 bbl. of gasoline at a loss this year in order to make up insufficient local production.

In Peru, products prices are among the world's lowest despite authorized increases last fall. However, in the government decree which raised prices, provision was made to revise prices semiannually on the basis of world market crude-oil prices and refining costs. The action resulted from a rising demand and constant domestic production which threatened to make oil imports necessary *(The Oil and Gas Journal, October 25, 1954, page 85).*

Borneo Wildcat Promising

The first promising show of oil in British Borneo since postwar exploration began has been discovered about 45 miles northeast of the Seria oil field.

A wildcat at Jerudong in the State of Brunei struck the oil-bearing formation at about 3,500 ft. The well was started on May 5. Drilling is continuing.

The well was located following geological and geophysical surveys carried out by British Malayan Petroleum Co., Ltd., an associate of the Royal Dutch-Shell Group. Shell had carried on intermittent exploration work in the vicinity without success since before World War I. In 1940, a deep test, Jerudong No. 1, reached a depth of 7,967 ft. and was abandoned as a dry hole.

Seria field produces about 100,000 bbl. daily of crude ranging from 19° to 38°-gravity. It was discovered in 1929 and produces from Pliocene and Triassic sands, ranging from 1,600 ft. to 6,900 ft. in depth.

Libya Attractive

Conflicts develop as dozen firms seek concessions

A DOZEN companies have applied for oil exploration acreage in Libya, but there are so many overlapping applications it may be months before concessions actually are granted.

The new Libyan oil law, in force less than a month, foresaw the possibility of such a situation. It provides that companies be given a chance to resolve any conflict themselves. If they are unable to do so, Libya's petroleum commission may compel rival applicants to pool acreage that overlap or it may settle disputes any way it chooses *(The Oil and Gas Journal, July 25, page 143).*

Because of the number of multiple conflicts, however, it is doubtful the companies will settle disputed areas among themselves. Industry observers believe the newly formed petroleum commission will have to do the job.

Eleven of the 12 companies applied for more than 50 separate blocks in the provinces of Tripolitania and Cyrenaica, north of the 28th parallel, but reports indicate all companies shunned Cyrenaica south of the 28th parallel. A subidiary of Standard Oil Co. (N. J.) was the only company applying for acreage in the province of Fezzan.

The companies applying for acreage in Tripolitania and the northern portion of Cyrenaica included American Overseas Petroleum, Ltd. (Caltex), Socony-Vacuum Oil Co. of Canada, Ltd. (Socony-Mobil), Jersey Standard, D'Arcy Exploration Co., Ltd. (British Petroleum), Royal Dutch-Shell group, Continental Oil Co., Ohio Oil Co., Amerada Petroleum Corp., Hunt Oil Co., Pancoastal Petroleum Co., C.A., and a newly formed Libyan subsidiary of Texas Gulf Producing Co. Compagnie Francaise de Petroles asked for acreage in only the northern part of Cyrenaica.

Under terms of the country's new petroleum law, royalty to the government is fixed at 12½ per cent and a 50-50 profit split is required after production reaches 15,000 bbl. daily.

Oil Men Look for Structures Off the Trucial Coast

This native dhow shoves off from the exploration vessel M/V Sonic to check for shoal waters ahead during seismic work off the Trucial Coast of the Arabian Peninsula conducted by Abu Dhabi Marine Areas, Ltd. The company, named after a nearby shaikhdom, is jointly owned by British Petroleum Co., Ltd., and Cie. Francaise des Petroles. The 405-ton Sonic is a converted landing craft belonging to Geomarine Service International. Last year, a team of divers participated in the geological survey of the area. The concession, covering about 12,000 sq. miles of submerged land, was acquired by BP and C.F.P. in March 1953 from Superior Oil Co. of California.

McCarthy's Bolivian Price Cut

STOCKHOLDERS of Glenn McCarthy, Inc., have approved an agreement turning over half interest in the company's 970,000-acre Bolivian oil concession in return for $2,000,000 to help develop the property. The price was less than half the figure earlier agreed on.

The payment will be made in monthly installments over a 17-month period. The money will be provided by a syndicate headed by Keljikan Commercial Corp., a New York import-export firm.

Unanimous approval of the agreement came after McCarthy, up-again-down-again Houston wildcatter, told stockholders that a recent audit showed the firm had a bank balance of only $53.38. McCarthy said he had lent the company more than $600,000 to continue operations.

As first announced, the agreement between McCarthy and the Keljikan group called for the syndicate to pay $4,160,000 *(The Oil and Gas Journal, June 27, page 81)*. The figure was reduced to $2,000,000 by a supplementary contract.

George Underwood, company geologist, said three wells have been drilled by McCarthy in Bolivia. He said the first well produced gas from about 3,200 ft. but it has not yet been tested.

The second well, he said, flowed gas at the rate of more than 48,000,000 cu. ft. per day from a sand at about 3,505-90 ft. in addition to 135 bbl. of oil daily from a shallower sand. The third test was drilled to about 3,500 ft. but has not been completed, and a fourth well is now being drilled.

All the wells are in the Los Monos area in the northern part of the big concession. McCarthy said he is committed to start drilling in the Agua Salada area, in the southern part of the concession, by November.

In addition to a half interest in the concession, the group furnishing the money for future operations was given a similar interest in the company's two drilling rigs and other equipment in Bolivia.

Consultant for Iran Line

Williams Brothers Co., Tulsa, has been engaged as consultant to Costain-John Brown, Ltd., in building a section of a new products pipeline in Iran.

H. W. Franks will direct the Williams Brothers supervisory personnel who will go to Iran in September. Work will move northward from Ahaw for 337 miles to Azna. Costain-John Brown holds an $18,200,000 contract for this section, which also includes four of the five pump stations planned for the system.

The entire line will consist of 10-in. pipe for 573 miles from Ahwaz to Teheran laid at a total cost of $32 million for National Iranian Oil Co. The section north of Azna will be built by Entrepose, a French firm.

An existing products line now operates between the Abadan refinery to Ahwaz, a town of 15,000 persons 75 miles north of Abadan. The new products line will have an initial capacity of 20,000 bbl. daily and an ultimate capacity with five more pump stations of 30,000 bbl. *(The Oil and Gas Journal, July 4, page 79)*.

Modernization Set

Stanvac will add cracker and poly unit in Sumatra

STANDARD-VACUUM OIL CO. soon will begin a $20,000,000 modernization program for its oldest and largest refinery, the Sungei Gerong plant near Palembang, Sumatra.

Improvements at the 71,000-bbl. daily refinery, owned and operated by Standard-Vacuum Petroleum Mij., will take about 2½ years. They are a part of Stanvac's 4-year $80,000,000 capital investment program in Indonesia *(The Oil and Gas Journal, January 24, page 76)*.

New installations will include a recycle fluid catalytic cracking unit of 10,000 bbl. daily feed rate. A nonselective catalytic polymerization plant of 1,100 bbl. daily output will transform light gases into high octane naphtha for upgrading gasoline.

Existing process equipment will be removed to boost throughput capacity of individual units and to efficiently handle crude which will come from Stanvac's new Lirik field. At the present time, additional power-generating facilities are being installed, and bids are being accepted for a new sulfuric acid plant.

Pipeline planned . . . Another project in Stanvac's over-all program is the construction of a 90-mile pipeline from Lirik field in Central Sumatra. The line, with a throughput capacity of 20,000 bbl. daily, will make the field's production commercially available for the first time. It will be completed in 1958. Coastal vessels will carry Lirik crude from the pipeline terminal to the refinery.

Stanvac also is building a modern office building in Palembang, adding facilities for employes, and carrying on field development work.

The company began marketing in what is now Indonesia in 1894. It became a producer there in 1914. More than 95 per cent of its 13,000 employes are Indonesians.

Expansion Finished

Pemex dedicates refinery units, new crude-oil line

THE refinery expansion project which doubled the capacity of the Atzcapotzalco refinery operated at Mexico City by Petroleos Mexicanos has been officially completed.

President Adolfo Ruiz Cortines and members of his cabinet took part in recent formal inauguration ceremonies for the units, which raise the refinery capacity to 100,000 bbl. daily. The project marks the end of a $15 million program which took 18 months to complete. It includes new refinery units and new pipelines from Poza Rica field to the refinery.

Pemex officials say the new refinery capacity puts Mexico temporarily ahead in its effort to keep refinery capacity ahead of consumption. The Mexico City refinery serves a rapidly growing market area of Mexico's Central Plateau.

Refinery expansion . . . Units added to the refinery include a 50,000-bbl. daily primary distillation unit, a 32,000-bbl. daily vacuum distillation unit, a 22,000-bbl. daily cat cracker, a 12,000-bbl. gasoline desulfurization plant, a catalytic polymerization unit, and expansion of the alkylation unit from 1,000 bbl. daily to 2,300 bbl. daily.

Pipeline construction . . . About 100 miles of the 147-mile, 18-in. crude line from Poza Rica field to Mexico City have been completed, and the line was formally dedicated the same time as the new refinery units. Expansion of the refinery made additional pipelines a necessity.

The new 18-in. line parallels an existing 10-in. crude line and also a 20-in. gas line serving the refinery.

In addition to the crude line, a 4-in. propane line capable of moving 5,000 bbl. daily is being built. The pipeline portion of the project is expected to be completed by October.

Israel Firm Begins Drilling

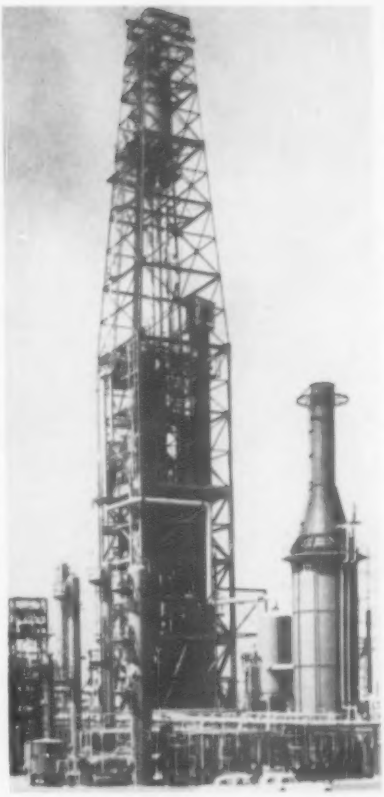
A recently organized firm, Israel Continental Oil Co., Ltd., has launched a drilling campaign hoping to be first to discover oil in the new State of Israel.

The firm's first well, the 1 Kurdani, has been spudded 3 miles northeast of Haifa Bay. It is 28 miles from a producing well drilled by American independents in Egypt.

Although Israel is located in one of the greatest oil producing areas of the Middle East, there have been no discoveries within the state itself. During the British Mandate following World War I, Palestine was mapped geologically by several American and European firms. Their interest was centered mainly east of the Arabian Shield because of the great oil discoveries in the Persian Gulf.

The oil fields of Kuwait, Bahrain, Qatar, Iran, Iraq, and Saudi Arabia lie on the eastern side of the shield. But a recent discovery in the Sinai Peninsula in Egypt south of Israel suggests the western area also may contain oil.

The Israeli Government in 1952 passed a new oil law designed to encourage foreign investment. It provides low tax rates and permission to withdraw most of the profits from oil ventures.



New T.C.C. Unit Operating

Hancock Oil Co. has placed a new 6,000-bbl. Thermofor catalytic cracking unit in operation at its Signal Hill refinery. Cost of the type-40-X unit, built by Ralph M. Parsons Co., was in excess of $5,000,000. In addition to the cat cracker a Universal Oil Products Co. catalytic polymerization unit was added.

International Briefs

Shell last week increased prices on two heavy Venezuelan crudes by 5 cents a barrel. Cia. Shell de Venezuela made the new postings effective August 4 at Cardon. They increased Lagunillas heavy crude of about 15° gravity to $1.90 and Bolivar district heavy crude of 12.5° to 12.9° gravity to $1.70 with a 3½-cent price change for each half-degree gravity change.

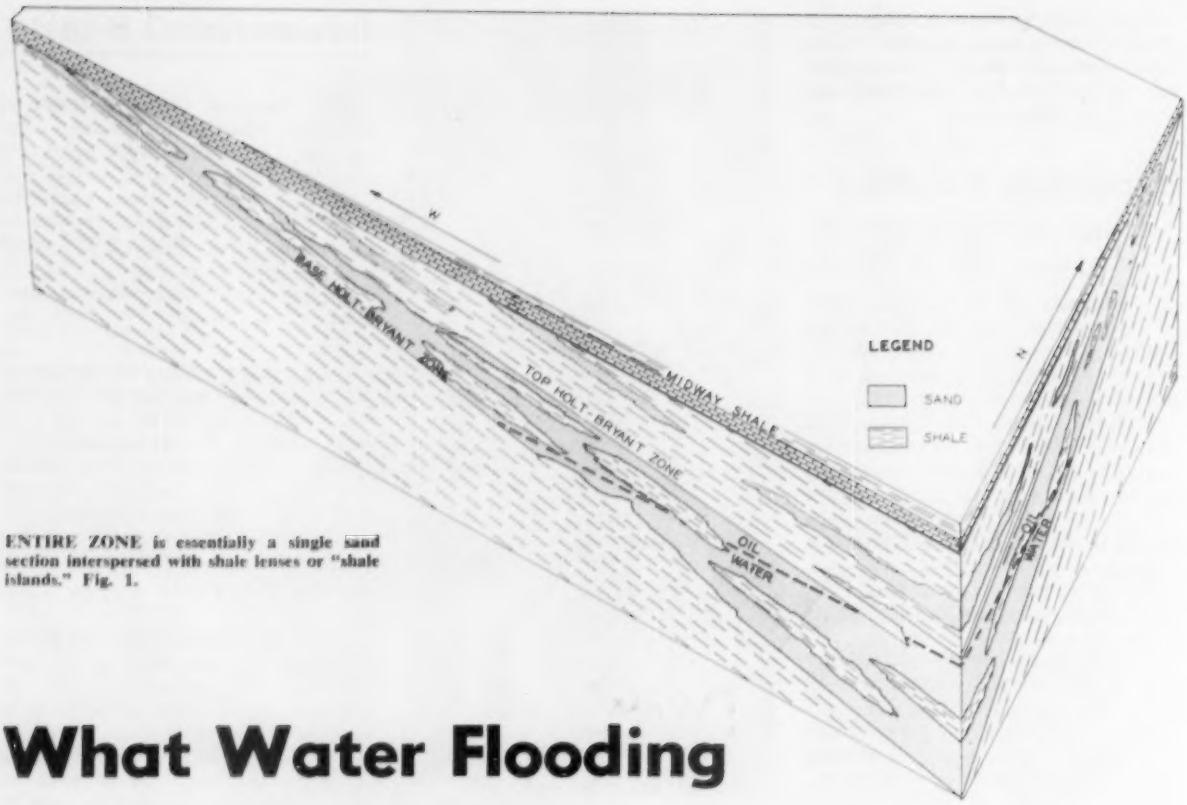
Ireland's first refinery will be built at Whitegate on the east side of Cork Harbour. Options on a 1,300-acre site have been taken by the participating companies—Esso Petroleum Co. of Ireland, Caltex Ireland, Ltd., and Shell-Mex and B.P., Ltd., Eagle, local marketing company for Shell, Eagle, and British Petroleum groups. Ireland imports 20,000 bbl. daily of products.

Esso Petroleum Co., Ltd., and British Petroleum Co., Ltd., will supply 60 per cent of the butane feed stock for the synthetic rubber plant to be built at Marl, Kreis Recklinghausen, Germany. It will process 70,000 tons of butane annually. The plant, to be built by Chemische Werke Huels, A.G., will be completed early in 1958. It will supply about 30 per cent of Germany's rubber needs *(The Oil and Gas Journal, July 11, page 103).*

G. V. Sims, managing director of Le Grand Sutcliff & Gell, Ltd., has taken over as chairman of the Council of British Manufacturers of Petroleum Equipment. He succeeds Douglas Wilson, of United Steel Companies, Ltd., who served for 3 years. The council heard a report that the industry is running at about £100 million a year, and business is expected to increase.

Preliminary plans have been made to form a company in Spain which will manufacture ammonia fertilizers from refinery gases and liquid products. Cia. Espanola de Petroleos, S.A., (SEPSA), owner of the 40,000-bbl. daily Santa Cruz de Tenerife refinery in the Canary Islands, will be the principal owner of the new company.

Stavros S. Niarchos, Greek shipping magnate, reportedly is seeking bids on the biggest supertanker yet built. The ship would be the first twin-screw tanker and would be capable of speeds of 20 to 22 knots. The tanker would displace 50,000 tons. Niarchos, brother-in-law of shipping operator Aristotle S. Onassis, built the 45,509-ton World Glory.



ENTIRE ZONE is essentially a single sand section interspersed with shale lenses or "shale islands." Fig. 1.

What Water Flooding Did for Delhi Field

Estimated life of field placed at 30-35 years, with a big increase in yield over that seen under primary depletion

by P. W. Meek and Paul B. Fletcher

WATER FLOODING Delhi field has proved to be a highly successful operation. In the first 15 months of water injection:

- Average reservoir pressure increased from 1,298 to 1,315 psi. Prior to effective pressure maintenance, a pressure differential of 239 psi. existed across the field. This has been cut to 107 psi.
- Expansion of original and secondary gas caps has stopped, and average produced gas-oil ratio has been reduced approximately 17 per cent.
- Daily water production has been reduced from 7,000 to 5,000 bbl.

Delhi oil field is located in the vicinity of the town of Delhi (northeastern Louisiana). Delhi is situated midway between Monroe and Vicksburg and embraces portions of Richmond, Franklin, and Madison parishes.

Authors are with Sun Oil Co., Dallas.

The discovery of the field was brought about by detailed subsurface geology which indicated the existence of a stratigraphic trap along the southern flank of a broad structure known as the Monroe uplift. Location of discovery well was based on seismic work which indicated a possible high area near the pinchout. The trap was caused by an overlapping of the older formation by a locally impervious bed known in this area as the Monroe gas rock (Navarro).

The productive formations in the field are of Tuscaloosa and Paluxy age (Upper and Lower Cretaceous, respectively). When fully developed, the field consisted of seven recognized reservoirs and numerous stray sands. The Holt-Bryant is the major reservoir in the field as it contained approximately 87 per cent of the total field hydrocarbons originally in place. Because of its importance, this article deals principally with data relating to the Holt-Bryant reservoir.

Geology of Delhi

The Holt-Bryant oil sand forms an elongated reservoir which embraces approximately 8,000 productive acres. The reservoir's longitudinal axis runs northeast-southwest approximately 12½ miles with its width varying between ½ and 2 miles. The reservoir's original net oil sand volume was calculated to be about 236,000 acre-ft. with an average net sand thickness close to 30 ft.

The reservoir was originally considered to consist of seven distinct sands. However, by careful examination and detailed correlation between well logs, it was later found that a sand in one well was apparently correlative with shale in another so that the entire zone

RESERVOIR PERFORMANCE curves for Holt-Bryant reservoir, Delhi field, Louisiana. Fig. 2.

was found to be essentially a single sand section interspersed with shale lenses or "shale islands" (see Fig. 1).

The reservoir originally had two gas caps, one in the midsection of the reservoir and the other in the eastern portion around the town of Delhi. The gas cap located in the midsection of the reservoir had an original gas-oil contact of 3,135 ft. subsea, and the eastern gas cap had an original gas-oil contact of 3,183 ft. subsea. The combined net sand volume of both gas caps represents a little more than 3 per cent of the net volume of the Holt-Bryant oil sand.

The entire Holt-Bryant reservoir thins updip. The impervious Monroe gas rock rests unconformably on the truncated edge of this reservoir, and the line of intersection of the producing sand with the base of the Monroe gas rock is the northern limit of Holt-Bryant production. The reservoir shales out to the west, and this shale barrier constitutes the west limit of the field.

Due to the southeasterly dip, the south and east limits of the reservoir are defined by its intersection with water, which at original conditions was at 3,286 ft. subsea. The average dip of the Holt-Bryant reservoir is approximately 350 ft. per mile.

Development . . . Discovery well was 1 J. E. Holt, a partnership well, of C. H. Murphy and Sun Oil Co. The well was completed on December 9, 1944, through perforations 3,280-90 ft., and on the initial 24-hour potential test it produced, through a 16/64-in. choke, 505 bbl. of 41.7°-gravity oil, no water, with a gas-oil ratio of 530 to 1 and a tubing pressure of 625 psig.

Forty-acre spacing was adopted for the field and the development progressed at a rapid rate. By 1948 the Holt-Bryant was fully developed with 188 producing oil wells (268 total field).

The Delhi terrain is rather low with an average ground elevation of about 90 ft. The wells were usually completed with 9⅝ or 10¾-in. surface casing set about 500 ft. deep and cemented to the surface. In most all cases the oil string was either 5½ or 7 in. set on bottom, cemented, and gun perforated.

Early in the development of the field, the operators recognized that this was a major oil discovery, and created an engineering committee to obtain and compile factual data of all wells in the area. Quarterly data of bottom-hole pressures, oil, water and gas production for all wells were collected for Delhi and surrounding fields (Big Creek, South Big Creek, North and South Delhi).

The Delhi Area Engineering Committee published these data in a quarterly report for the various participating operators:

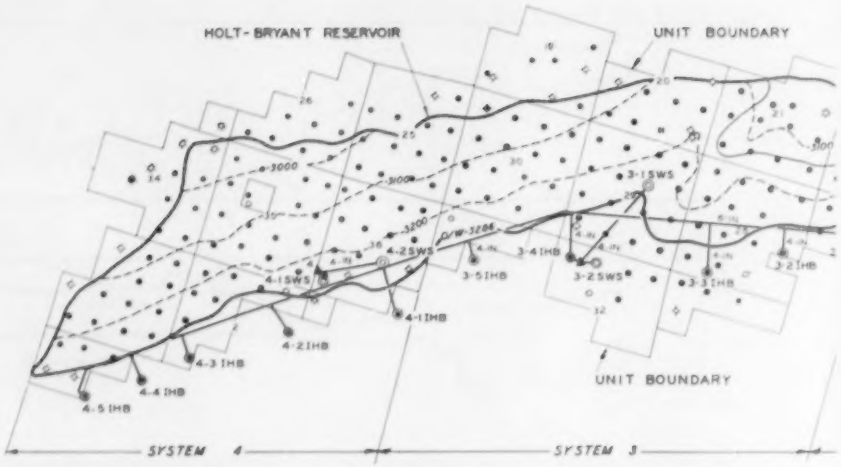
DISCOVERY WELL in the field is Delhi Unit 106-I.

HOLT-BRYANT RESERVOIR DATA

Average elevation, ft.	90
Well spacing, acres	40
Range of producing depths (subsea), ft.	—2,970 to —3,286
Reservoir area:	
Gas caps, acres	900
Oil sands, acres	8,000
Net acre-feet of sand:	
Gas caps	8,000
Oil sands	236,000
Average net sand thickness:	
Gas caps, ft.	8
Oil sands, ft.	30
Original gas-oil contacts (subsea), ft.	—3,135 and —3,183
Original oil-water contact (subsea), ft.	—3,286
Average sand porosity, per cent	32
Average connate water, per cent	35.0
Permeability:	
Range, md.	0-9,550
Average, md.	1,380
Original reservoir pressure, psig. at —3,135 ft.	1,530
Reservoir temperature, °F.	135
Stock-tank gravity of oil, °A.P.I.	40
Type of crude oil	Sweet
Casing-head gas:	
Gravity, avg.	0.83
Gal. per M.c.f. (avg.)	5.0
Formation volume factor (avg.)	1.242
Gas-saturation pressure, psig.	1,530
Viscosity of reservoir oil, cp. at 135° F.	0.7 to 0.8
Gas originally in solution (avg.), cu. ft./bbl.	462

The Holt-Bryant oil was saturated at original reservoir conditions with approximately 462 cu. ft. of gas in solution per stock-tank barrel of oil. The oil volume factor was found to vary slightly from one end of the reservoir to the other with an average formation volume factor of 1.242. The Holt-Bryant is a very prolific sand and from core analyses of 240 samples the average permeability was found to be 1,380 md.

Gasoline plant . . . As Delhi and surrounding fields approached complete development, there was approximately 14,000 M.c.f. of casing-head gas being flared daily. In the interest of economy and the conservation of natural resources, the operators in the area



HOLT-BRYANT reservoir, Delhi field, Louisiana. The reservoir, which is about 12 miles

completed a casing-head gasoline plant in May 1948. The plant ownership of each operator was determined by the proportion of his acre-feet of oil sand to the total acre-feet represented in the plant membership.

The gasoline plant is a low-pressure plant with an inlet capacity of 17 million cubic feet of gas per day and has extraction facilities for propane, butane, and natural gasoline. To January 1, 1955, the plant had processed 34,400 M.M.c.f. of 15.025-psi. gas and recovered 1,200,000 bbl. of propane, 1,200,000 bbl. of butane, and 1,400,000 bbl. of gasoline.

Reservoir Performance

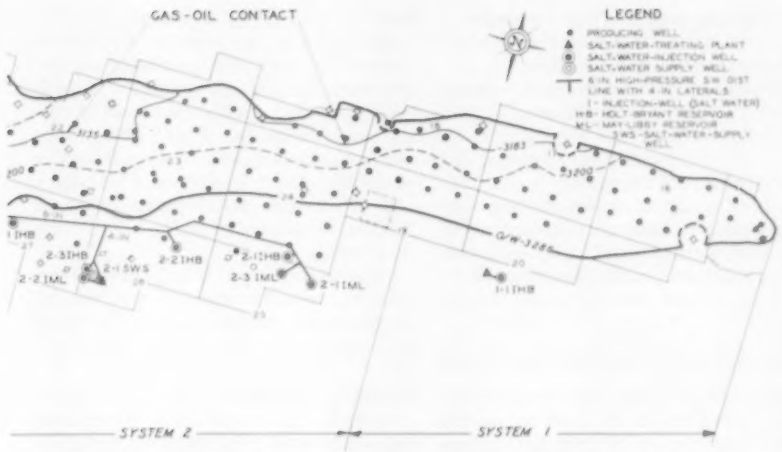
The original bottom-hole pressure of the Holt-Bryant reservoir was estimated to be 1,530 psig. at 3,135 ft. subsea. Early in the producing history of the reservoir, the pressure declined between 3 and 16 psi. per quarter year (see Fig. 2). The magnitude of pressure decline was not considered alarming at that time because it was anticipated that an efficient water drive would develop when sufficient pressure differential between the aquifer and oil zone had been created.

Meanwhile, the disposal of produced salt water became a major problem and by 1948 surface pits in many instances were inadequate. However, Murphy-Sun solved the problem by means of subsurface disposal. The water was collected in a closed system, filtered, and returned to the aquifer through salt-water-disposal wells. By September 1950, Murphy-Sun had two disposal wells in operation and Gulf had one.

Even though the natural water drive was supplemented by returning a portion of the produced water to the aquifer, it was found to be inadequate for pressure maintenance. By 1949 the Holt-Bryant oil allowables had been successively reduced from a maximum of 125 to 87 bbl. of oil per well per calendar day at request of operators.

After each reduction in allowable, it was hoped that the natural water influx, aided by the return of produced water, would be sufficient to maintain reservoir pressure. However, the res-

TREATING STATION No. 2. Equipment includes two vertical filters, two accumulator tanks, and two vertical triplex pumps.



long and ½ to 2 miles wide, has an estimated oil sand volume of 236,000 acre-ft. Fig. 3.

ervoir pressure continued to decline and steps were taken to determine the reservoir voidage rate that would sustain a constant pressure.

Calculations, in conjunction with Sun's electronic analyzer study, revealed that the natural water drive was not capable of sustaining a constant reservoir pressure at an economic well allowable. It was determined that an immediate reduction in the per well allowable to 30 bbl. of oil per day for each of the 187 producing wells would approach conditions necessary for maintaining constant reservoir pressure. Even this measure would not have been a permanent solution since further periodic reductions would have been required to maintain a constant pressure.

Pressure decline . . . When it became evident that the Holt-Bryant reservoir did not have sufficient water drive properly to deplete its reserves, Murphy-Sun, as major operators, called a meeting of the Delhi operators in December 1950 to discuss the problem and decide on a proper course of action. In order that the Holt-Bryant pressure problem could be thoroughly investigated and corrective measures taken, legal, geological and engineering committees were appointed to aid the operators.

The operators instructed the engineering committee to study the situation and recommend to them the most practical and efficient means of arresting the pressure decline.

The engineering committee found the most desirable means of maintaining the Holt-Bryant reservoir pressure and increasing its ultimate oil yield was by injection of extraneous water. By such injection it was estimated that the recoverable oil reserves of the Holt-Bryant could be increased from 40 to 65 per cent of the total amount originally in place.

Water flood . . . Water was chosen as the injection medium instead of gas due to the geological configuration of the reservoir and since it was recognized that water would flush the oil sand more efficiently, and at a lesser cost than would gas. A source of extraneous water was readily available from the Wilcox sand which is encountered at a depth of approximately 1,700 ft. and which is known to extend over the entire field.

The Wilcox sand has a gross thickness of approximately 1,000 ft., and averages several hundred feet in net thickness. Salt water from the Wilcox sand has been known to flow on numerous occasions when drilling muds were too light or when taking drill-stem tests of the section. Therefore, it was reasonable to assume that extraneous flood water could be obtained under flowing conditions with practically no lifting costs involved.

Later this was substantiated when it was found that each salt-water supply well was capable of delivering water under flowing conditions. The capacity of these wells range from 1,200 to 12,000 bbl. of water per day per well.

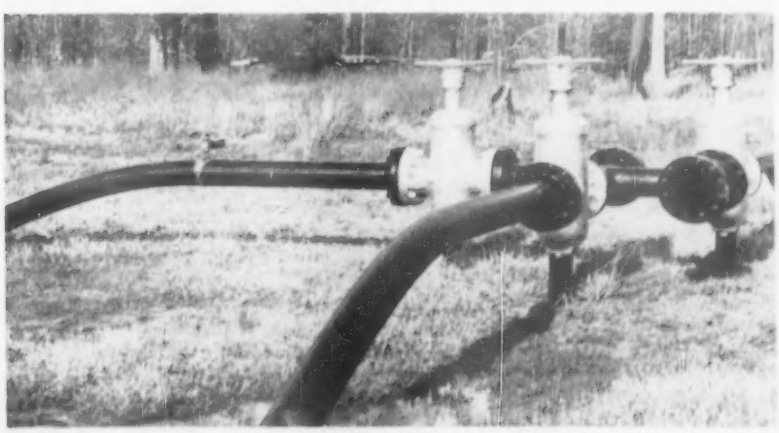
Following the engineering studies, water flooding of the Holt-Bryant reservoir was recommended to the operators, even though it was recognized that a successful line flood would cause a movement of fluids across lease boundaries. The problem was studied by the legal committee and it was their recommendation that the Holt-Bryant be unitized prior to water flooding.

Therefore, the operators charged the engineers with the problem of determining a suitable formula for unitizing the Holt-Bryant reservoir in order that an extraneous water-injection program could be initiated.

After the geological committee had prepared the necessary structural and isopachous maps for the engineers' unitization study, a large number of unitization formulas were considered in an attempt to find one that would be acceptable. Finally, the engineering subcommittee decided upon a formula of 50 per cent net acre-feet of oil sand and 50 per cent legal oil production. This 50-50 formula was formally approved by the operators.

Due to the overlapping of certain reservoirs and multiple reservoir penetration of many well bores, the operators instructed the engineering and geological committees to compile data for complete unitization of all remaining hydrocarbon sands within Delhi field. These sands were unitized along with the Holt-Bryant reservoir under the same 50-50 formula.

The effective date of unitization was 7 a.m., February 1, 1953. The cumulative Holt-Bryant production data to that date was 41,378,786 bbl. of stock-tank oil, 6,342,114 bbl. of salt water, 18,983,334 M.c.f. of gas, and a total of 2,645,742 bbl. of produced salt water was returned to the aquifer.



SCRAPER POCKET on 6-in. main line. Line to left is 6-in. main. Line at bottom is 6-in. from treating station. Line to right is continuation of 6-in. main.

Proposed Plan of Operation

In September 1952, a "Proposed Plan of Operation" was submitted to

the various participants in an effort to effect an early agreement, which upon approval, would permit finalizing of plant details, early placement of orders for critical items of equipment, and acquaintance of the operating personnel with the detailed plans. This plan was very comprehensive with specific plans and accompanying maps and diagrams for:

1. Gathering produced salt water through a gravity system of cement-asbestos lines, part of which were already installed for disposal of produced water.

2. Water conditioning and pumping to be accomplished by four treating and pumping stations. Due to the lack of operational difficulties encountered in using a closed-type system while disposing of produced water and realizing the need for preventing the exposure of salt water to air, the closed-type system was chosen for the water-injection program. The plan called for the mixed water to be passed through filters containing excelsior and graphilter and into accumulator tanks, from which triplex pumps, driven by electric motors, would inject the filtered water into a 6-in.-diameter steel line as a common header, with 4-in. lateral lines to the individual injection wells.

3. Testing the capacity of water supply wells and also the compatibility of the extraneous water with that produced along with oil.

4. Drilling and completing injection and supply wells.

5. Tank-battery consolidation. At that time, there were 248 wells producing into 154 tank batteries, which could be consolidated into 47 batteries and still accommodate effective zone separation or production and retain all individual well treating and testing facilities. This would reduce production costs, facilitate the gathering of produced water, and minimize the number of treater installations.

6. Electrification which would permit fully automatic operation, and less down time due to prime-mover service and repair.

Pilot-flood test . . . While negotiations for unitization were proceeding, a pilot flood was initiated. To test the compatibility of the Wilcox salt water with that produced along with the oil, a temporarily abandoned well (later designated 3-1 SWS) was completed in the Wilcox interval, after isolating the formations below by installing a bridging plug and the formations above by block squeezing the uppermost section of the Wilcox formation.

A chemical analysis showed the Wilcox to have a chloride content of approximately 23,000 p.p.m., compared to 55,000 p.p.m. in the produced water. Testing the well proved its ability to flow in excess of 5,000 bbl. per day through a 4-in.-diameter line.

Mixing the two waters and injecting them into one of the existing disposal wells, after filtering, was begun and after several months of operation, the compatibility of the waters was assured when no plugging tendencies were encountered. During this same period, coupons were exposed at various locations to determine any corrosive effects with the results being esesntially negative.

Unit Operation and Injection System

Sun Oil Co. took over as unit operator February 1, 1953, the effective date of unitization. During the summer of 1953, work was begun to put the proposed plan into operation.

Main line . . . A 6-in. steel line, coated and wrapped and tested at 1,000 psig., was laid across the southern extremity of Systems 2, 3, and 4 (see Fig. 3). System 1 is operated independently because:

1. It is the primary entry of natural water influx, consequently having the highest average pressure and requiring less injected water.

2. The terrain presents an obstacle to the continuation of a common line across the entire field.

From this 6-in. pressure line were laid 4-in. laterals to the sites of the various injection wells.

Drilling and completion of wells . . . Meanwhile, drilling of the supply and injection wells was initiated employing four power rigs. No conventional coring was done as electric logs were considered adequate for selecting the injection interval. Surface casing, 10¾-in., was run to approximately 500 ft. and cemented to the surface. Long string, 7-in., was set through the section to be perforated and cemented with 200 sacks of common cement with 4 per cent gel.

Drilling rigs were released after the long string was set and workover rigs were moved in to complete the wells. The supply wells were bullet perforated with mud in the hole, then bailed until flow was induced. Tubing, 2-in. EUE, with a casing brush, was run in the injection wells and salt water was circulated to remove the mud.

After perforating, 2½-in. EUE internally plastic-coated tubing was installed, equipped with a hookwall packer, a 450-psi. valve, nd four 500-psi. flow valves (external), in that order, from bottom to top. The wells were then backflowed by compressing gas down the annulus.

Total drilling amounted to 2 supply wells, 10 Holt-Bryant injection wells, and 1 May-Libby injection well. In addition, one temporarily abandoned May-Libby well was converted for injection and one existing disposal well was deepened and gravel packed. In this operation, over 4,000 perforations were made at a cost of approximately $16,000. As of January 1, 1955, there are 14 Holt-Bryant injection wells, 3 May-Libby injection wells, and 5 Wilcox supply wells.

The injection rate into each injection well is controlled by a plug valve and is measured through a 3-in. high-pressure meter.

Treating stations . . . Stations 2 and 4 consist of two 10 by 15-ft. vertical filters and two 10 by 20-ft. accumulator tanks and two vertical triplex pumps. Station 1 is a single system and while water normally gravitates into the lone System 1 injection well, a duplex pump is available to boost injection when necessary.

Station 1 is served only by produced water gathered in System 1. Station 3 is also a single system, but is connected to the 6-in. main line with a single vertical triplex pump. This latter station is designed to accommodate an additional filter, accumulator, and pump when warranted.

Electrification . . . Simultaneously with the drilling, field-wide electrification was begun. A 13.8-kva. line was installed across the field with a three-phase stepdown transformer bank at each of Stations 2, 3, and 4.

The pumps are 3½ by 5-in. vertical triplexes, rated at 90 hp. and capable of delivering 7,700 bbl. per day each, at 360 r.p.m. and 675 psig. These pumps are belt driven and originally 40-hp. electric motors were used as prime movers with sheave sizes determining the amounts of fluid to be handled by each pump.

The use of both mercoid and magnetrol level controls, installed on the accumulator tanks, has proved satisfactory for controlling the starting and stopping of the pumps.

Tank-battery consolidations . . . Prior to unitization, an inventory of every lease was taken, giving the operator the information necessary for the moving of tanks and treating and testing equipment. Existing stock tanks ranged from 210-bbl. welded to 1,000-bbl. high bolted tanks. As batteries were abandoned, the tanks were moved to the consolidated battery intact.

This proved to be considerably less expensive than having the tanks knocked down and reerected. In addition to the normal treating and separation facilities at each battery, there is an electrically driven centrifugal circu-

lating pump, used to romove tank bottoms and maintain pipeline oil.

To January 1, 1955, 15 of the 154 tank batteries, existing prior to unitization, have been eliminated, the project being 47 per cent complete. Since the Delhi Unit is a voluntary one with some interests outstanding, the operator has necessarily maintained separate oil storage on tracts not 100 per cent unitized.

Water injection . . . Effective water injection was begun October 1, 1953. The original plan of operations was slightly modified after considering the results of studies made with the Sun Oil Co. electronic and potentiometric analyzers. From these studies, it was determined that injection rates into the various wells would range from 500 to 4,000 bbl. per day, the first goal in mind being to arrest the pressure decline and also eliminate the existing east to west pressure differential.

The results of these studies form the basis for the Delhi Unit water-injection program.

Problems Overcome

The most serious production problem in Delhi has been the rapid accumulation of paraffin in the tubing. Mechanical scraping methods have proved satisfactory in removing the paraffin depositions, but are extremely costly due to the frequency involved. To combat this problem, the unit operator has tested various paraffin solvents and inhibitors with little relief.

To January 1, 1955, a large amount of success has been attained by replacing the upper one-half of the tubing in 15 wells with internally plastic-coated tubing. Plans have now been formulated to alleviate the costly paraffin problem by a rapid replacement of present tubing with a similar amount of internally coated tubing in the remaining wells.

Injection . . . In attempting to increase the flow from one of the supply wells, the uppermost section of the Wilcox formation was perforated. The use of this water plugged two of the filters and, when examined, were found to contain a heavy deposition of calcium carbonate. Chemical analyses of the water proved it to differ markedly from the other Wilcox water, having a chloride content of 9,000 p.p.m. as compared to 23,000 p.p.m.

In addition, the water was found to be unstable with a super saturation greater than 50 p.p.m. with respect to calcium carbonate. The addition of a complex phosphate was unsuccessful in completely eliminating the precipitation of calcium carbonate and the upper zone was shut off.

Subsequent testing in another supply well in the same vicinity showed only the interval from the top of the Wilcox to approximately 1,800 ft. to be troublesome. Although the water obtained at 2,000 ft. has a chloride content of only 11,000 p.p.m., it is stable, compatible water.

Present daily injection requirements are approximately 21,000 bbl. per day and as individual injection well rates occasionally fall below the desired rates, it has been necessary to acidize and backflow the wells to improve their injectibility. This method of cleanup has proved to be somewhat expensive and numerous tests are under way to determine the cause of periodic plugging and a method of economically eliminating this operation.

Among these tests are:

1. Continuous injection of small quantities of acid to lower the pH of the water, since the produced water is acidic and the extraneous water is basic.
2. Slug treatments with small quantities of acid.
3. Installation of "sock" filters to determine the degree of filtration being obtained.
4. Injectivity index tests to locate the more pronounced permeability differences from well to well.
5. Tests to determine friction losses in the tubing.
6. Coupon exposures to determine any corrosive effects.
7. The effects of wellhead-pressure differentials caused by periodic shutdown of the pumps.
8. Injection of a surface-active agent directly into one of the injection wells.

Another difficulty encountered has been the higher-than-anticipated injection pressures. These high pressures have forced overloading of the 40-hp. electric motors, causing the pumps to occasionally be kicked off the line and have prevented the system from operating under a desirable constant pressure.

Plans were approved to replace the 40-hp. electric motors with 100-hp. electric motors, assuring a maximum of 675 psig. from the 90-hp. pumps. The replacement of these motors was started in March 1955.

Injection Results

Since inauguration of the Delhi Unit, the Louisiana Department of Conservation has issued an order which, in essence, permits the operator to close in wells and transfer their allowables to more efficient wells in the same reservoir, subject of course, to certain requirements and restrictions.

This program of pressure maintenance through water injection, made possible by voluntary unitization, is a sound conservation measure and has been highly successful to date. Lifting costs have been reduced with the field being produced more efficiently than possible under competitive operation. In addition, through tank-battery consolidation, the unit operator now has the same amount of personnel handling 50 per cent more wells.

In 15 months (October 1, 1953 to January 1, 1955), the reservoir had responded very well to water injection. The average reservoir pressure has been increased from 1,298 psig. to 1,315 psig., a total of 17 psi. Prior to effective pressure maintenance (October 1, 1953), a pressure differential of 239 psi. existed between the extreme eastern well and the extreme western well.

On January 1, 1955 this differential was measured to be only 107 psi., a decrease of 132 psi. Had this differential been allowed to continue increasing, the migration of fluids from east to west would have become more acute, resulting in a premature loss of wells to water and consequently a loss of oil.

The injection of water has also stopped the expansion of original and secondary gas caps. The average produced gas-oil ratio has been reduced approximately 17 per cent. In addition, daily water production has been reduced from approximately 7,000 bbl. per day to 5,000. Under competitive operations, it is estimated that the daily water production in 1955 would have been in excess of 12,000 bbl. per day.

During January 1955, another analysis was made using the Sun Oil Co. electronic and potentiometric analyzers with the results being highly favorable. The study was projected through 1958 and illustrated the degree of equalization of reservoir pressure across the field, eliminating the east to west migrational effect and allowing the water to displace the oil upstructure to insure maximum recovery.

The importance of the electronic and potentiometric analyzers as reservoir tools is recognized by the unit operator and these intsruments deserve a great deal of the credit for the success of this program.

The estimated life of the field is placed at 30 to 35 years, with a substantial increase in ultimate oil yield over and above that expected under primary depletion.

To January 1, 1955, 50,117,534 bbl. of oil, 11,206,975 bbl. of water, and 23,180,863 M.c.f. of gas have been produced from the Holt-Bryant reservoir. Total water injected amounts to 9,667,743 bbl.

References

1. Prutzman, F. G., "The Delhi Area Fields, Louisiana," Petroleum Engineer, p. B-7, February 1950.

2. Rhea, A. S., "Development of Delhi Oil Field," Petroleum Engineer, p. 158, November, 1945.

BEFORE Power line on right-of-way in Central Missouri overgrown with scrub oak in July 1953. Fig. 1.

AFTER Same location as at left 1 year after spraying with ammonium sulfamate. Fig. 2.

Chemicals Cut Pipeline R.O.W. Upkeep

Here are results of a 4-year program by Shell Pipe Line on chemical control of weeds and brush on pipeline right-of-ways. Savings over hand-clearing are in the range of

- 90 per cent for weeds and grass
- 80 per cent for scrub oak and brush
- 60 per cent for mesquite

by Neil G. Wilson
Shell Pipe Line Corp.

WHEN experiments with a new maintenance operation promise to cut costs below the old method, the new method is likely to be adopted. Results considered reasonably successful have been achieved in a 4-year project to study chemical control of weeds and brush along right-of-ways of pipelines, communications and power lines, and in tank farms. This project was undertaken by the experimental engineering laboratory of Shell Pipe Line Corp. to evaluate chemicals that might cut the labor cost of controlling vegetation. Maintenance personnel were spending a large portion of the working year cutting brush.

The first job was to find methods of chemical control which could be used on cross-country right-of-ways. On these right-of-ways, woody vegetation often grew back to a height of 15 ft. within 3 years after cutting or bulldozing.

To be acceptable, chemical-control methods would have to control mesquite, Osage orange, scrub oaks, and various mixtures of brush species. Yet soil "sterilization" along the right-of-way would be undesirable because of the risk of erosion or damage to grazing areas.

Later experiments have dealt with soil "sterilization." The object was weed and grass eradication in places which had to be hand-cut, particularly inside tank dykes and around valve manifolds.

Major classes of control . . . The areas traversed by Shell Pipe Line vary enough in natural vegetation, rainfall, etc., so that brush-control recommendations cannot be uniform. In addition, state laws restrict the use of hormone herbicides in Louisiana and parts of Texas.

For general maintenance purposes, five brush and weed-control situations have been defined:

1. Mixed species of brush (elm, oak, ash, sumac, gum, mulberry, poison oak, poison ivy, maple, etc.).
2. Osage orange and mesquite.
3. Annual broad-leaved weeds.
4. Large, scattered, woody plants.
5. Grass and weeds occurring where bare soil is desired.

In the first four categories, heavy growth on more than 50 miles of right-of-way has been sprayed on an experimental basis using several types of herbicides. All treatments were made during the growing season. In the fifth category, selected sites at five tank farms have been treated with various herbicides for complete kill of all vegetation.

In addition to the areas where detailed comparative studies have been made, about 100 miles of right-of-way for pipelines and telephone lines have been treated with chemical brush killers. Also, 40 acres of tank farm area and other installations have been treated for total kill. This work was part of the regular maintenance program.

Brush control costs reduced . . . The cost of hand-cutting mixed brush 5 to 15 ft. high averaged $650 per mile per 5 years on 22 miles of 10-ft.-wide telephone-line right-of-way in northern Oklahoma. Spraying with a solution of water and ammonium sulfamate will cost an estimated $130 per mile per 5 years for the same right-of-way—a probable saving of 80 per cent.

Such spray applications in 1952 and a retouch spraying again in 1954 have provided better and cheaper control than hand-cutting methods. Permanent kill with the first treatment was estimated to be about 85 per cent.

Another chemical brush-control job involved an 8-mile power line right-of-way in central Missouri. A mile of this line runs through cultivated fields. The balance was overgrown with scrub oak in 1953, even though it had been

BEFORE Telephone-line right-of-way in northern Oklahoma overgrown with Osage orange. Fig. 3.

AFTER Same location as at left next season after spraying with 2,4,5-T. Fig. 4.

scraped with a bulldozer when constructed in 1950.

Two miles had already been hand-cut in 1953 when it was decided to treat the rest with an ammonium sulfamate spray solution. Brush on the remaining 5 miles was so heavy that a crew of six men working with hand tools could clear only about a quarter-mile of 50-ft. right-of-way in a day. This 5-mile stretch was sprayed in 1953 at a cost of about $400 per mile, or considerably less than the estimated $600 per mile cost of hand-cutting. This treatment achieved a permanent kill estimated at 75 to 85 per cent. Figs. 1 and 2 show the results.

This right-of-way will be retouched, probably in 1956, at an estimated cost of $150 per mile. Subsequent treatments every 3 to 4 years will maintain cheap, effective control. Chemical-treating costs decline because retreating is required only to kill new growth and the small percentage of plants surviving prior treatments.

Cost of treatment with a contact killer such as ammonium sulfamate varies with plant size and density. For an average 50-ft.-wide pipeline right-of-way, the cost of hand-cutting and the first chemical treatment are roughly comparable. Subsequent treatments with the chemical cost considerably less, usually running one-fourth to one-third the cost of the first treatment.

Hormone Herbicides

Where the growth to be killed is chiefly mesquite or Osage orange, hormone herbicides have given excellent results. The chemical may be either 2,4,5-T (2,4,5 Trichlorophenoxyacetic acid) alone or 2,4,5-T plus 2,4-D (2,4 Dichlorophenoxyacetic acid). On broad-leaved annual weeds, 2,4-D alone may be used. Either of these is, of course, subject to local herbicide regulations.

Over 25 miles of Osage orange on a telephone right-of-way in northern Oklahoma and Kansas were treated with hormones in 1951. In 1952, resprouted plants were sprayed. With the first treatment, about 98 per cent top-kill and 85 per cent root-kill was achieved. After the second treatment, straw was piled in the larger hedge rows and the rows were burned. This right-of-way will not have to be treated again. Previously, hand-cutting or bulldozing was necessary every 3 to 5 years. One section of this right-of-way is shown in Figs. 3, 4, and 5.

AFTER Same location as in photos above two seasons after spray treatment. Dead Osage orange had been burned after piling straw in row. Fig. 5.

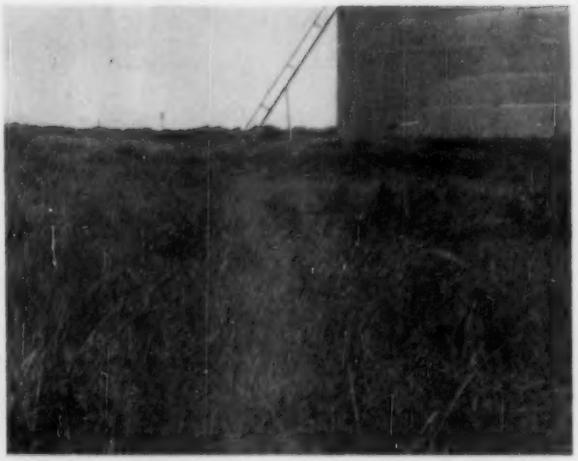
The average cost for completely eradicating this 25 miles of hedge was $65 per mile. Previously, where the landowners' permission could be obtained, the hedge rows were bulldozed about every 5 years at a cost of $250 per mile. When hand-cutting was necessary, the cost was about $1,000 per mile per 5 years.

Mesquite roots killed . . . Mesquite on 1½ miles of West Texas right-of-way was treated with 2,4,5-T in July 1953. Complete top-kill was achieved with one treatment and about 25 per cent of the plants resprouted. These were mostly plants which had been previously hand-cut and had a high root-to-foliage ratio. The entire 50-ft.-wide right-of-way was sprayed for about $50 per mile.

It was estimated that to hand-cut this right-of-way would have taken a crew of five men 2 days. The spraying was done by two men in 6 hours. With hand-cutting, the plants resprout and therefore require cutting about every 3 years. Since mesquite resprouts several shoots for every one cut off, each succeeding cutting is more difficult than the last.

In the same areas where ammonium sulfamate solution achieved 70 to 95 per cent kill of mixed brush, the hormone materials were tried in three successive seasons. It gave poor results. Only 30 per cent permanent kill resulted after the third application.

Where woody plants to be killed are large and/or scattered, basal treatment with a hormone herbicide may be the most satisfactory method of control. Although some trials have been made, this method is generally used only where the amount of treating does not justify bringing in power equipment.



BEFORE Area inside tank dike in the Gulf Coast region before treating with 3-(p-chlorophenyl)-1, 1-dimethylurea. Fig. 6.

AFTER Same location as in photo at left 2 years after treating. Area is completely cleared of vegetation. Fig. 7.

Basal treatment is most effective if done during the dormant season with a hand-sprayer. A solution of 1 pint of 2,4,5-T (½ lb. 2,4,5-T acid equivalent) in 2 gal. of kerosine or fuel oil should be applied around the entire plant base from the ground up to about 18 in. on the trunk. The lower portion of the trunk or stem should be thoroughly soaked.

Soil Sterilization

Several herbicides have been tried for soil sterilization at tank-farm sites in Oklahoma, West Texas, and the Gulf Coast. The object at each location was complete eradication of various perennial species such as Johnson, quack, nut, water, and Bermuda grasses. A most satisfactory herbicide found to produce effective soil sterility was a nonselective killer based on 3-(p-chlorophenyl)-1, 1-dimethylurea. Test applications were effective where the chemical was applied at a dosage of 50 lb. per acre.

This material is a wettable powder which is applied in a water suspension. Its water solubility is about 250 p.p.m. It works principally through the roots, so it should be applied when there will be enough rainfall to carry the chemical down into the root zone. Applied in the spring, before growth starts, it can prevent plant growth throughout the season.

It does not kill seeds but is absorbed by seedling roots. So seeds in treated soil often sprout, only to die back as the chemical takes effect. This chemical may be applied to dense weed growth if sufficient water is used—perhaps 500 to 800 gal. of water per acre. But better results are usually obtained if vegetation is mowed and matted growth cleared away in order to apply the material on the ground.

A test plot of 3-(p-chlorophenyl)-1, 1-dimethylurea applied at a Gulf Coast site in June 1952, still showed over 95 per cent control of weeds and grass in July 1954. For more than a year, control rated 100 per cent. Results of this application are shown in Figs. 6 and 7.

Cost of weed control . . . Material cost for using 3-(p-chlorophenyl)-1, 1-dimethylurea is about $150 per acre. Labor costs vary according to the equipment used for application. Total costs at several sites averaged $215 per acre, compared with an annual hand-cutting cost of $615—or a saving for 1 year's control of $400 per acre.

If 2-year control prevails when this chemical is used, the cost would be around $110 per year, or a saving of about $500 per acre per year under conditions normal to the Southwest. This comparison is based on three cuttings yearly. Where weeds and grass can be machine-cut, this is of course the cheapest method.

Factors to Be Considered

Factors to be considered in chemical control of vegetation include selection of the best chemical for the species to be killed, selection of proper weather conditions and time of year, complete coverage of the plant with spray solution, safety precautions to avoid damage to crops and ornamentals, selection of proper spray equipment, and compliance with state laws.

None of the chemicals mentioned in this article are flammable. Furthermore, they are low in toxic hazard to people and animals under conditions recommended for use. By observing proper precautions, hazards to crops and ornamentals can be avoided.

For treating Osage orange and mesquite, either the ester or the amine form of 2,4,5-T is preferred. It should be purchased on the specification of 4 lb. of acid equivalent per gallon of preparation. Where grass is to be left unharmed, 2,4-D is satisfactory for control of weeds. Since all hormone-type preparations are somewhat volatile, care should be taken to avoid drift of spray or fumes into crop areas. Wind direction and velocity should be considered when spraying.

When the growth to be treated is a mixture of several varieties of brush, ammonium sulfamate weed and brush killer is preferred. It is quite soluble and can be applied in a solution at the rate of ¾ lb. per gallon of water. A commercial spreader-sticker should be added to the solution.

Each Situation "Special"

Each situation must be evaluated separately. If perennial species were not a problem and other conditions permit machine mowing, it might take 15 years for chemical spraying to show any economic advantage. But our experience indicates that, under most conditions, chemical spraying will pay off in a much shorter time.

The excellent control of vegetation which has been obtained with chemicals at greatly reduced cost has freed a substantial number of man-hours for other maintenance work.

From our experience and the reports of others, it is expected that we can map out chemical weed and brush control on a "cycle" basis, scheduling an optimum number of spray crews so that they can keep vegetation permanently under control throughout the pipeline system.

It will be necessary to plan spraying operations so that crews can cover the system and get back to the first-sprayed areas before regrowth becomes serious. Such a plan will permit level or declining annual budgets for this phase of maintenance.

Beam pumpers overpowered? Here's a handy way to get

Better Estimates of Energy Needs

In one of its districts, Shell Oil Co. has cut down the oversizing of electric motors on beam-pumped wells. The result has been a saving of $40 to $200 per well in investment cost. Moreover, the power bill has been cut by 7 per cent. Shell has done this by using a new, simpler method of estimating the motor size and energy requirements. This article outlines the method.

by W. J. Fairbanks
Shell Oil Co.

DURING a recent modernization project, some 400 beam-pumped wells in the Ardmore district of southern Oklahoma were electrified. In doing this, it was necessary to estimate the best size of electric motors and the energy requirements for the pumping units. The usual methods were tried, but they were unsatisfactory for these reasons:

1. They overpower the wells that need only agitation to maintain natural flow.

2. They are hard to use. These old methods generally use factors that are either extremely difficult to figure or that depend too heavily on individual well conditions.

If better formulas and methods could be found, they would help save money on electrical equipment and on power bills. So, a study was made of the power and energy requirements on hundreds of beam-pumped wells in the district that were already electrically powered.

Although several factors are involved, the depth of lift and theoretical pump displacement are most important. If these two things are known, the power and energy requirements can be very closely estimated. However, on the wells that produce by agitation, the help from reservoir energy must also be taken into consideration.

The relationships that came out of this study have given better estimates than any others used in the Ardmore district. The relationships are given as formulas and curves on Figs. 1 through 4; expressed in words, they are:

1. The motor-input horsepower is a linear function of depth of lift and theoretical pump displacement.

2. The percentage of rated horsepower that can be used in beam pumping is a nonlinear function of the depth of lift. Only a part of the rated horsepower can be carried by an electric motor under a cyclic load like that of a beam-pumped well; otherwise, the motor will overheat. In the past, motors commonly have been derated a fixed percentage regardless of the individual load. The amount has usually been 70 to 75 per cent.

3. The motor rating needed is a nonlinear function of depth of lift and theoretical pump displacement.

4. The input energy needed to produce a given amount of fluid is a linear function of depth of lift.

Proven reliable . . . These relationships are reliable not only for wells pumping under dead lift, but also on wells producing by agitation. The aid from reservoir energy, on the average, brings the power and energy requirements for

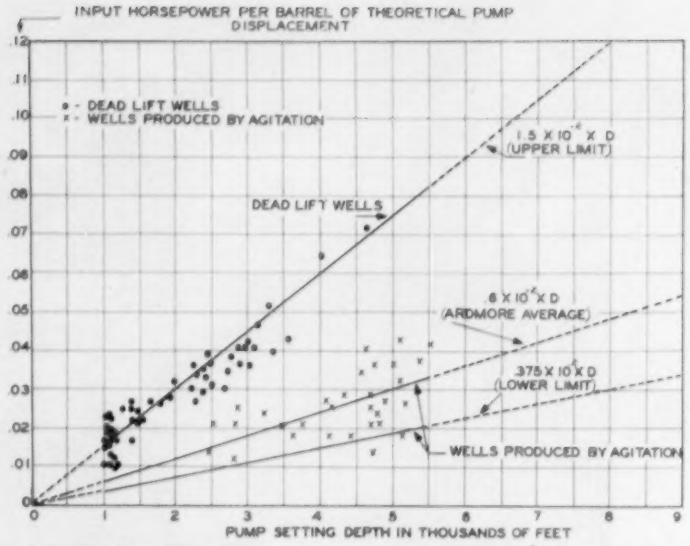
the Ardmore district's agitated wells down to about 40 per cent of that for the dead-lift wells. The effect of the reservoir energy varies, however, from well to well and gradually decreases with time.

How to use them . . . Tables 1 and 2 show how the new relationships are used in the Ardmore district. They have been very satisfactory there, and should be satisfactory in other fields. In these tables the term, "produced by agitation," has been used to describe wells which have almost enough reservoir energy to produce by natural flow. Pump plunger loads for such wells are low and mere reciprocation of rods and displacement of the plunger are enough to make the well produce. The term, "dead lift," refers to wells with very low reservoir energy which have pump plunger loads equal to the full weight of the fluid column.

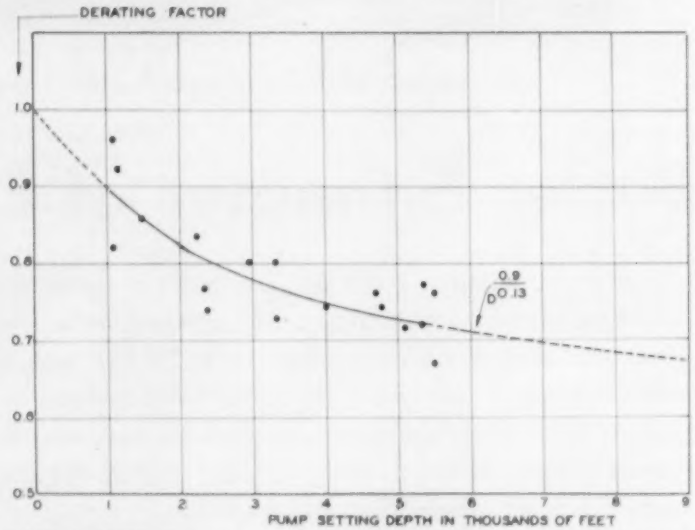
As Table 1 shows, selecting a motor for a well producing by agitation often takes careful consideration of the well's future condition. At first, a well produced by agitation may need only 25 to 40 per cent as much power per barrel of pump displacement as does a dead-lift well. But, a motor picked on this basis will be overloaded after the dead-lift condition is reached unless pump displacement is reduced.

In this district, agitating wells producing from depletion-type reservoirs have their pump displacements reduced as the wells decline to dead lift. Thus, a motor selected on the basis of the initial displacement will still be large enough after the dead-lift condition is reached. If higher water production is expected, the motor cannot be sized on the basis of present conditions, but rather it must be sized to satisfy future dead-lift conditions.

The energy requirements . . . Table 2 makes a point about a group of wells


INPUT HORSEPOWER PER BARREL OF THEORETICAL PUMP DISPLACEMENT
• - DEAD LIFT WELLS
x - WELLS PRODUCED BY AGITATION
1.5 X 10⁻⁴ X D (UPPER LIMIT)
DEAD LIFT WELLS
6 X 10⁻⁵ X D (ARDMORE AVERAGE)
.375 X 10⁻⁴ X D (LOWER LIMIT)
WELLS PRODUCED BY AGITATION
PUMP SETTING DEPTH IN THOUSANDS OF FEET

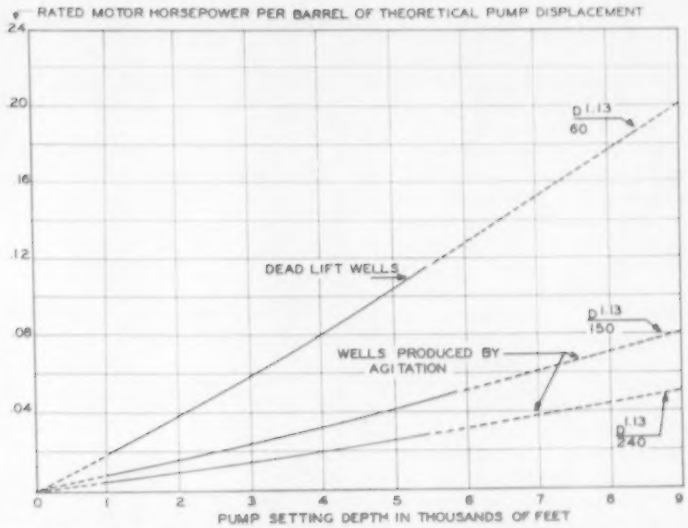
FLOW OF SOME WELLS by agitation decreases the lifting power required. Fig. 1.



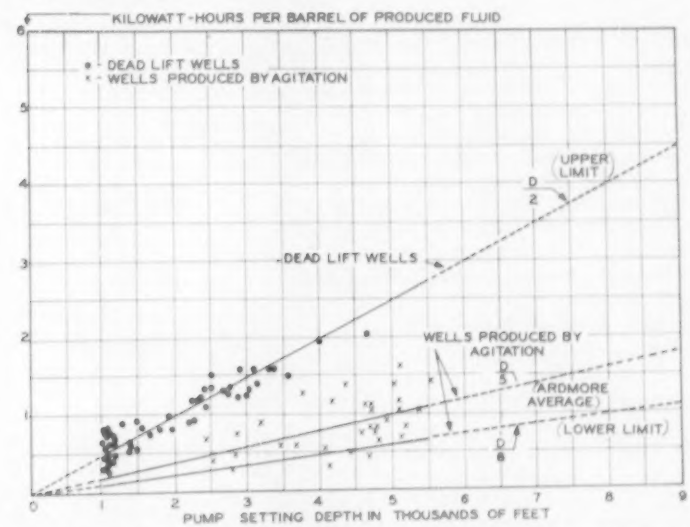
ELECTRIC-MOTOR power output must be derated because of heating during cyclic pumping loads. Fig. 2.

TABLE 1—DETERMINATION OF MOTOR SIZE

Well classification	Possible future conditions	Curve to be used	Recommendations
Dead lift	Decline of fluid production.	Dead-lift curve of Fig. 3.	Use the theoretical pump displacement required for present conditions, and if a triple-rated motor is to be used, consider the determined horsepower rating as that required of the high horsepower winding.
Dead lift	Increase of fluid production.	Dead-lift curve of Fig. 3.	(1) When possible to estimate future fluid production, use the probable pump displacement that will be required at that time. If a triple-rated motor is to be installed, use the indicated horsepower as that required of the high horsepower winding. (2) If the increase of water cannot be estimated, but is not expected to be great, use the present pump displacement and consider the determined horsepower as the required size of the low winding of a triple-rated motor.
Produced by agitation.	Over 4 to 1 decline in fluid production by time dead-lift condition is reached.	Ardmore average curve or own average curve.	Use the theoretical pump displacement required with present conditions, and if a triple-rated motor is to be used, consider the determined horsepower as that necessary for the high winding.
Produced by agitation.	Less than 4 to 1 decline in fluid production by time dead-lift condition is reached.	Both Ardmore or own average curve and dead-lift curve.	Calculate the motor size that would be required for present conditions and also the size that might be necessary at a future date. Use the larger indicated motor size. If a triple-rated motor is to be installed, this size should be the rating of the high winding.



REQUIRED HORSEPOWER of motors depends on type of production and derating factor. Fig. 3.



REQUIRED ENERGY for pumping different types of wells is a linear function of depth. Fig. 4.

produced by agitation which have declined toward dead lift by different degrees. The average kilowatt-hour per barrel requirement for the wells can be more reliably estimated by the average curve than by the lower limiting curve.

The average curve may remain reasonably accurate for some time. This is particularly true if the wells that have recently stopped flowing are being steadily added to the original group of wells. Otherwise, the energy consumption will gradually go up and the average curve will be inaccurate.

This rise of energy consumption cannot be found accurately since the relationships involved have not been found. As a result, this energy rise must be estimated roughly from the behavior of the wells. In some fields, the fall of oil production may give an indication. In other fields, the decline of gas-oil ratio or bottom-hole pressure might be used. With research, it should be possible to find accurate relationships in terms of one or more of these factors.

The average curves on Figs. 1, 3, and 4, are reliable for most estimates in the Ardmore district. It might be necessary to make different average curves for other fields. The limiting curves should, however, be universal.

How Formulas and Curves Were Derived

After the necessary data were collected from electrically powered wells, the factors that influence power and energy requirements were studied.

Horsepower input . . . First, input horsepower per barrel of theoretical pump displacement was plotted against pump setting depth. As Fig. 1 shows, this plot has definite trends, but the points are scattered slightly. In an attempt to reduce the scattering, several more variables like the pump diameter, volu-

TABLE 2—ESTIMATION OF LEASE ENERGY REQUIREMENTS

Type of wells on lease	Anticipated development of lease	Curve to be used	Recommendations
All dead lift.	None	Dead-lift curve of Fig. 4.	Use the average pump setting depth of all wells on the lease for determining the average kw.-hr. barrel requirement.
All produced by agitation	Steady increase in number of wells requiring pumping.	Ardmore average or own average curve.	Use the average pump setting depth of all wells on the lease.
Mixture of dead-lift wells and wells produced by agitation.	Steady increase in the number of wells requiring only agitation to produce.	Ardmore or own average curve and dead-lift curve.	To find the lease kw.-hr. per barrel requirement: (1) Determine average pump setting depth of all dead-lift wells; (2) calculate the average kw.-hr. per barrel for these wells from the dead-lift curve on Fig. 4; (3) determine the average pump setting depth of all wells produced by agitation; (4) calculate the average kw.-hr. per barrel for these wells from the Ardmore average curve on Fig. 4 or from a similar average curve derived in your locality; (5) multiply the determined kw.-hr. per barrel for dead-lift wells by the approximate daily production of these wells; (6) multiply the kw.-hr. per barrel determined for wells produced by agitation by the approximate daily production of these wells; (7) sum the kw.-hr. consumption of both types of wells (found in Steps 5 and 6) and divide the total by the daily production of the lease.
All produced by agitation of mixture of dead-lift and agitated wells.	None	Presented curves not accurate.	In this instance, the wells will gradually decline toward the dead-lift condition and the Ardmore average curve will be inaccurate until dead-lift stage has been reached. During this decline period, attempts should be made to correlate the rise of energy with one or more indicative well conditions.

metric efficiency, and gas-oil ratio were tried. However, they gave no help.

After looking at the individual wells, it was found that the scattering of points was caused by reduction of pumping loads made possible by energy from the producing formation.

Since this scattering could not be eliminated, no single expression will hold good for all wells. Therefore, an approximate approach was used. This was done by placing limiting straight lines on charts. These limits are related only to pump setting depth and theoretical pump displacement.

The upper limit on Fig. 1 is valid for dead-lift wells only. The lower one is valid only for wells that flow when agitated. However, wells represented by this lower limit will decline toward dead lift. As they do, their power requirements are more accurately shown by another straight line somewhere between the two limiting lines.

The wells in the Ardmore district vary as to the rate and stage of decline toward dead lift. Therefore, a third line for average conditions was fixed. It is this average line and the upper limit that have been most helpful.

The straight lines of Fig. 1 are expressed by these formulas:

Dead-lift wells (upper limit)

$$P_i = 1.5 \times 10^{-2} B \times D$$

Wells produced by agitation (Ardmore district average)

$$P_i = 0.6 \times 10^{-2} B \times D$$

Wells produced by agitation (lower limit)

$$P_i = 0.375 \times 10^{-2} B \times D$$

where:

P_i = average input horsepower
B = theoretical pump displacement in barrels per day
D = pump setting depth in thousands of feet

At 1,100 ft. . . . On Fig. 1 there is some scattering of points above and below the dead-lift limit. Reservoir pressure has no effect for the wells represented by these points. Therefore, the variation of input horsepower among these wells of the same depth is due to other factors. These factors may be pump size, efficiency of surface equipment, and volumetric efficiency of the pump.

A study of the wells represented by these points indicated the following: (1) Those above the dead-lift limit were low-fluid-capacity wells, and (2) those below the curve were the higher-capacity wells. The higher-capacity water-producing wells require less power per barrel because they have better volumetric efficiency in the pumps and better efficiency in the electric motor.

The low-capacity wells are pumped with single-rated 1-hp. motors. These motors operate between 35 and 50 per cent of full load. On the other hand, the larger wells have triple-rated motors. They operate between 50 and 80 per cent of full load.

Horsepower derating factor . . . The name-plate rating of an electric motor is limited by the allowable operating temperature under constant load. When the motor is subjected to the high peak currents of cyclic beam-pumping loads, it will overheat unless operated at an average horsepower less than the name-plate rating. For this reason, the delivered brake horsepower must be less than rated horsepower. The same is true of input horsepower.

To find the best motor size, we may say:

$$\text{Horsepower derating factor} = \frac{\text{Maximum allowable motor input horsepower}}{\text{Rated motor horsepower}}$$

Data from 18 representative wells were used in making the curve in Fig. 2. By a curve-fitting process, the curve was found to have this expression:

$$M = \frac{0.9}{D^{0.13}}$$

Where M is horsepower derating factor and D is the pump setting depth in thousands of feet.

Motor Size

Fig. 3 gives motor sizing curves. These were delineated from data by dividing the average input horsepower values from Fig. 1 by the appropriate derating factor. Three separate curves show the input horsepower in Fig. 1; therefore, three curves are needed in Fig. 3. The curves have these formulas:

Dead-lift wells (upper limit)

$$P_m = \frac{D^{1.13}}{60}$$

Wells produced by agitation (Ardmore district average)

$$P_m = \frac{D^{1.13}}{150}$$

Wells produced by agitation (lower limit)

$$P_m = \frac{D^{1.13}}{240}$$

Where P_m is rated motor horsepower per barrel per day of theoretical pump displacement, and D is pump setting depth in thousands of feet.

Kilowatt-hours per barrel . . . Kilowatt-hours per barrel values were figured using measured input horsepower figures. For 90 representative wells this equation was used:

$$K = \frac{0.746 \; P_i \times H}{B_p}$$

where:

K = kilowatt-hours per produced barrel of fluid
P_i = average input horsepower
H = pumping hours required
B_p = fluid produced in barrels per day

Fig. 4 shows the plot of kilowatt-hours per barrel against pump depth. Just as in Fig. 1, the points are scattered. Two other variables, necessary pumping hours and volumetric efficiency, were tried. They had no beneficial effect on the scattering. To take reservoir energy into account, three straight lines are used as before. The lines have these formulas:

Dead-lift wells (upper limit)

$$K = D/2$$

Wells produced by agitation (Ardmore district average)

$$K = D/5$$

Wells produced by agitation (lower limit)

$$K = D/8$$

Where, as before, K is kilowatt-hours per barrel of produced fluid and D is pump-setting depth in thousands of feet.

THE AUTHOR

W. J. Fairbanks is district mechanical engineer, Ardmore, Okla., district, Shell Oil Co. He joined Shell in the Tulsa area office in 1950, after receiving his M.S. degree in mechanical engineering from University of Michigan. Fairbanks, a native of Hastings, Pa., is a World War II veteran.

THE BATES POOL CASE . . . Was its

Discovery Due to Use of Oil-Base Mud?

Fig. 1—Bates pool.

. . . Seven dry holes surrounded it, six within 1,000 ft. Operator gives credit to mud used

by Donald M. Davis

A SMALL oil pool in the Devils Den area of northwest Kern County, California, is of particular interest because of the circumstances of its discovery. Based on all available evidence it appears the operator's use of oil-base drilling fluid was directly responsible.

Bates pool was discovered in June 1954, by Kenmac Oil Co. 27X-20 Bates estate. The pool opener was completed in an Etchegoin sand through perforations at 1,440-1,560 ft. Initial daily production was 50 bbl. of 25°-gravity crude. The discovery well and three subsequent producers represent the northernmost Pliocene oil production in San Joaquin Valley.

Author is vice president, Artnell Oil & Gas Co., Inc., Los Angeles. During the time of this study he was a consulting geologist.

The discovery was completely surrounded by seven dry holes and one noncommercial producer. Six of these were within 1,000 ft. as shown in Fig. 1.

Prior to the drilling of the discovery, almost every possible technique had been employed in an effort to produce the Bates zone. These included use of low-water-loss starch muds, barefoot bailing tests, and pump tests after gun and jet perforating. In none, however, had oil-base fluids been used to drill the pay zone.

Bates pool production is in a sand zone which shales out updip to the southwest, along the northeast flank of the Devils Den nose as shown in Fig. 1. Dips average 40° to the northeast. Depth to the sand varies from 1,100 to 1,750 ft.

The producing zone consists of silts, fine-grained silty sand, claystones, and mixtures of all types. It varies in over-all thickness from 75 to 100 ft. where it has been penetrated. Oil saturation occurs wherever sufficient permeability exists. Some rich, loose oil-sand stringers occur throughout and probably total 15 to 35 ft. Permeabilities range from 2 to 500 md., with an over-all average of 20 to 75. Porosities average from 20 to 35 per cent. The connate water contains 2,100 grains per gallon of sodium chloride.

Prior exploration . . . Many tests have been drilled in the region during the past 35 years. Unfortunately many were prior to the advent of electric logging and accurate recording of data. A complete study of the area is very difficult. In Figs. 2 to 7, however, are shown electric logs of six wells drilled prior to the discovery.

. . . Well A (Fig. 2) was drilled in 1944-45, using a clay-water mud, to a total depth of 9,181 ft.

As shown in Fig. 2, Well A is about 100 ft. from an earlier dry hole. Completed in 1937, it was the first test to indicate oil possibilities of the Bates zone.

. . . Well B was drilled to 1,276 ft., with a clay-water fluid, in May 1946. It was the first of four tests drilled in search of Bates production. It logged 20 ft. of oil sand (Fig. 3) which indicated definite correlation of oil saturation and permeability. The section as cored was predominately silty sand with thin streaks of fine-grained oil sand.

. . . Well C was abandoned a month later after drilling to 1,549 ft. with clay-base mud. Some 25-30 ft. of sand was logged (Fig. 4). Cores showed thicker streaks of oil sand, but the 91-ft. interval was mostly silty and fine grained.

. . . Well D, drilled in June 1946, was the first of two tests to use starch-type muds. After drilling to 2,341 ft. and setting pipe at 1,901 ft. (Fig. 5), the interval 1,740-70 ft. was perforated. Prior to perforating the starch-base fluid was replaced with salt-water. The well was suspended after it bailed dry.

When opened a year later it flowed 6 bbl. of 27°-gravity crude before dying. On later pump tests minor amounts of crude were produced. Re-perforating and further swabbing failed

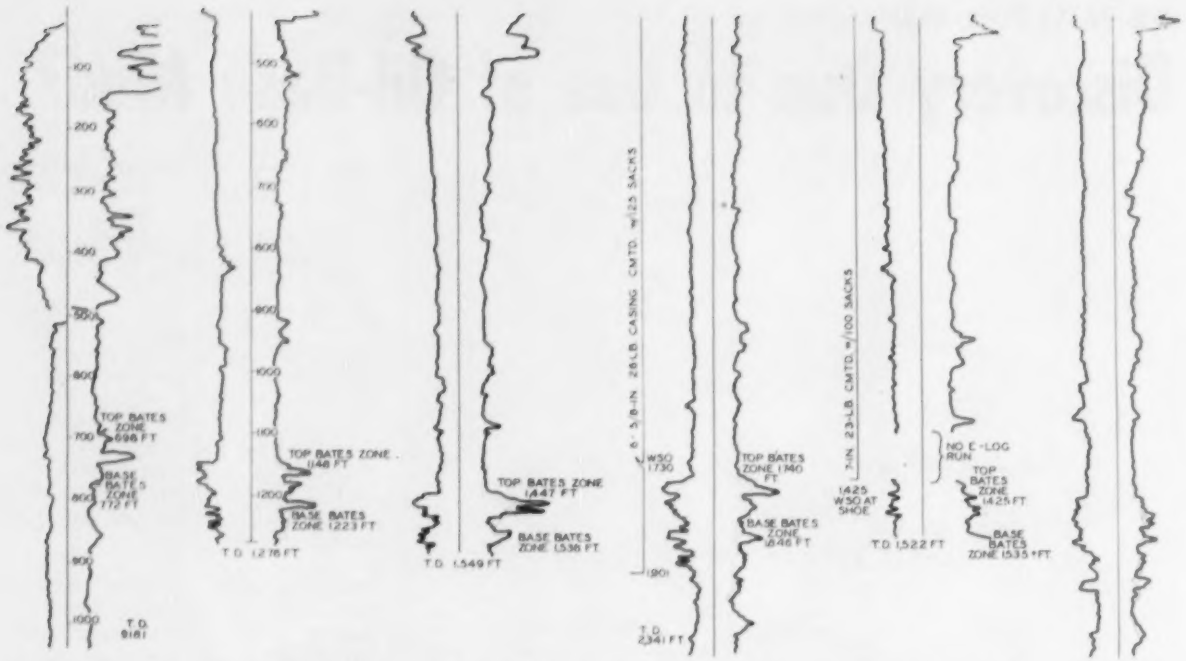

TOP BATES ZONE 698 FT
BASE BATES ZONE 772 FT
T.D. 916'
TOP BATES ZONE 1148 FT
BASE BATES ZONE 1223 FT
T.D. 1276 FT
TOP BATES ZONE 1447 FT
BASE BATES ZONE 1536 FT
T.D. 1549 FT
8-5/8-IN. 28-LB. CASING CMTD. W/125 SACKS
W.S.O. 1730
TOP BATES ZONE 1740 FT
BASE BATES ZONE 1846 FT
T.D. 2341 FT
7-IN. 23-LB. CMTD. W/100 SACKS
1425 W.S.O. AT SHOE
NO E-LOG RUN
TOP BATES ZONE 1425 FT
BASE BATES ZONE 1535+FT
T.D. 1522 FT

Fig. 2—Well A. **Fig. 3—Well B.** **Fig. 4—Well C.** **Fig. 5—Well D.** **Fig. 6—Well E.** **Fig. 7—Well F.**

ELECTRIC LOGS of Bates pool wells show the development of the sand. Although logs and cores of these wells indicated 20 to 40 ft. of oil sand, no oil was produced.

to improve production so that in 1949 the well was abandoned.

This well had 35 to 40 ft. of oil sand but it was a fine-grained, silty sand which ranged from firm to firm-friable. Core analyses showed an average porosity range of 24 to 30 per cent, and permeabilities of 2 to 282 md.

...Well E, drilled in July 1946, again indicated starch-type mud was not the answer to the problem of water-blocking. In drilling to 1,522 ft. the Bates zone was encountered below 1,425 ft. (Fig. 6). No fluid entry was observed after 15 hours of bailing and it was abandoned.

Cores indicated less sand was present than at the other locations. About 15 ft. of oil sand was logged but only as thin stringers throughout a silty sand and siltstone section. Core analysis showed 21 to 35 per cent porosity and 2 to 300 md. permeabilities.

...Well F was drilled in March of last year. It was planned to core slim-hole through the Bates zone using a clay-water mud. The invaded zone would then have been removed by underreaming, using oil as the drilling fluid. The oil sand zone was found several hundred feet higher than was expected, however, so that the planned program could not be carried out for mechanical reasons.

Cores, sidewall samples, and electric logs showed only limited amounts of permeable zone (Fig. 7). The oil sands logged, totaling about 20 ft., were firm, silty, and rather tight.

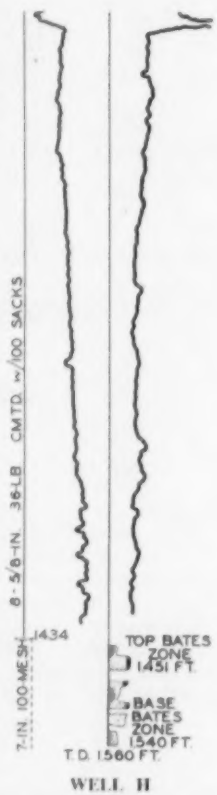
...Well G, also drilled in March 1954, logged about 20 ft. of oil sand. Cores obtained were very clayey and tight, with very limited saturations. These and electric logs indicated the program of setting casing and underreaming with oil was not warranted.

The discovery . . . Well H was the discovery well completed using oil-base mud.* After setting casing on top of the Bates zone, the water-base fluid was displaced with oil-base. This was used while drilling the oil sand to 1,560 ft. and while the liner was being run. It was then replaced with crude oil.

The section cored showed a possible total of 25 ft. of permeable oil sand, which occurred in an 89-ft. interval as shown in Fig. 8. Remainder was fine-grained, silty oil sand and siltstone.

Following completion of the discovery—in the middle of this group of dry holes—three other oil producers were completed. Jacalitos Petroleum Co. 1-2 Bates Estate, Well I in Fig. 1, pumped 50 bbl. daily through perforations at 1,602-1,920 ft. Last November its 1-3 Bates, Well J, made a 48-bbl. pumper from the Bates sand at 1,816-1,925 ft. Early this year Kenmac Oil Co. 2 Capco-U.S.L. was added about ½ mile south of the area shown. Completed with an oil-base mud, as were the others, it pumped 22 bbl. daily from 1,493-1,593 ft. on initial tests.

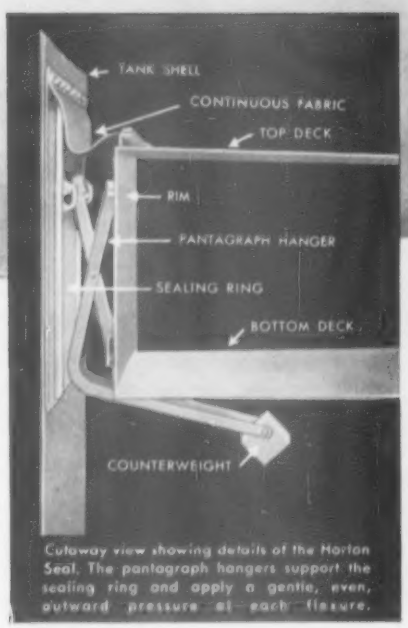
*"Ken-Flo," a product of Ken Corp.



WELL H

DISCOVERY WELL, was drilled in with oil-base rather than water-base mud. About 25 ft. of oil sand, shown by the black portions of the cored section, accounted for the 50-bbl. daily production. Fig. 8.

A Horton Seal paying its way...



Cutaway view showing details of the Horton Seal. The pantograph hangers support the sealing ring and apply a gentle, even, outward pressure at each flexure.

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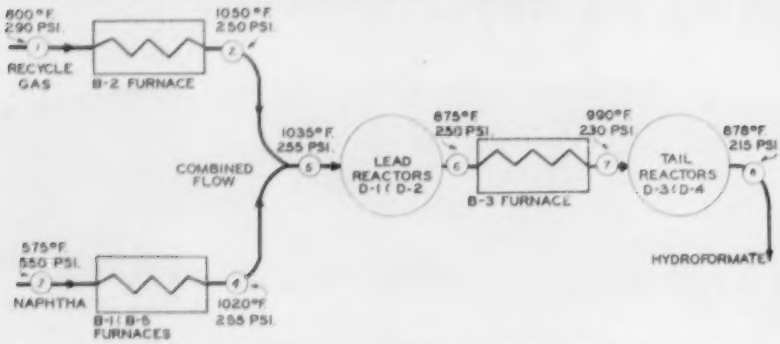
Humble's Metallurgical Group—2



SCHEMATIC FLOW SHEET for Humble's fixed-bed Hydroformer unit. Fig. 1.

When Reformer Piping Failed

. . . trouble sleuths found out why—and acted

by F. Lawrence Resen
Gulf Coast Refining Editor

THE metallurgical group at the Baytown refinery of Humble Oil & Refining Co. has solved a number of problems that have occurred in operating the fixed-bed Hydroformer.

Special problems have been experienced with materials in recycle-gas service, and with carbon-steel tubes in the waste-heat boiler. After some study, alloy-steel replacement tubes of 1¼ per cent Cr, ½ per cent Mo steel were selected for recycle-gas service. These tubes are in excellent condition after 3 years' service. Special tests were developed to insure successful welding of this special steel.

A schematic diagram of the Baytown Hydroformer unit is shown in Fig. 1. Original piping up to 12-in. diameter and operating above 650° F. in the hydrocarbon system was fabricated of 4-6 Cr-½ Mo steel. Larger sizes were fabricated from clad plate (carbon-moly steel base plus ⅛-in.-thick Type 410 stainless-steel cladding) by rolling and welding longitudinally.

Sections of this piping were replaced by carbon molybdenum steel pipe and many service data were also obtained on this material.

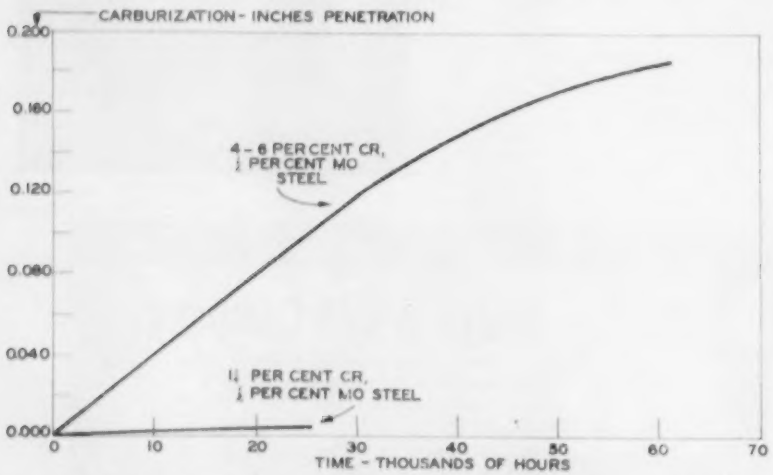
Piping failures . . . The numerous piping failures which occurred are as follows:

1. Seamless 4-6 Cr-½ Mo steel pipe exposed to recycle gas at temperatures above 850° F. carburized extensively on the inside surface (Fig. 2). While no actual failures occurred, tests showed the carburized layer (⅜-in. deep carburization on ⅞-in. original wall thickness) to be extremely brittle and to have a high hardenability, thus magnifying operational hazards and complicating repair procedures.

2. Longitudinal welds in the clad pipe developed extensive cracks in the austenitic (25-20 Cr-Ni) welds. Although specified for only the liner weld, some longitudinal welds were made entirely with austenitic electrodes. No entirely satisfactory explanation of the cracking was developed, but it was not a problem associated with carburization.

3. Numerous cracks were observed in other austenitic welds throughout the hydrocarbon system.

4. Cracks developed in welds in carbon-molybdenum steel piping (used as replacement for clad piping) in the recycle-gas system. Certain specimens of carbon molybdenum steel showed little deterioration in 4 years' service while others showed appreciable spheroidization of the carbide phase or surface decarburization.



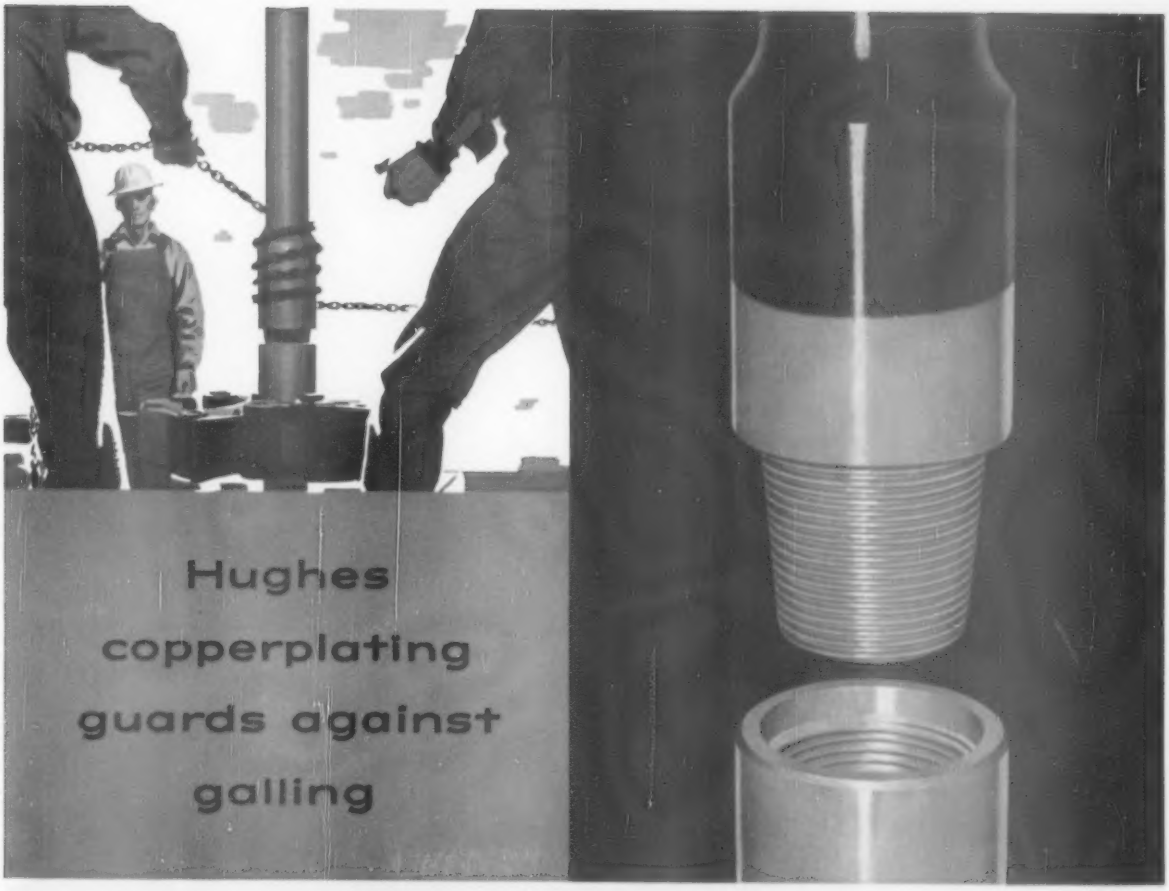
CARBURIZATION RATE, 4 to 6 per cent Cr, ½ per cent Mo; B-2 furnace outlet. Fig. 2.

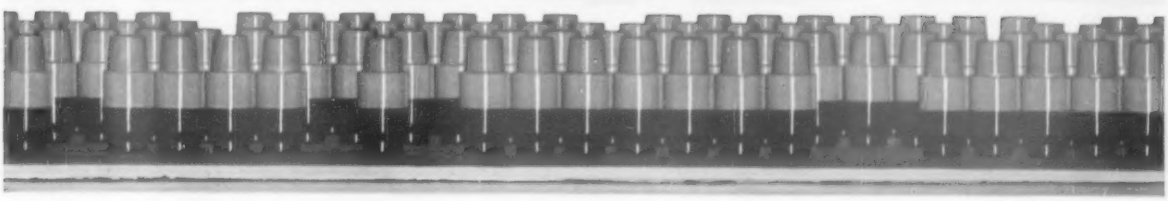
New piping . . . Because of advanced deterioration of the recycle-gas piping, the decision was made in January 1948 to replace the affected sections. Several considerations influencing the selection of replacement material were: (1) material must have adequate mechanical and creep strength at operating temperatures; (2) austenitic materials were considered unsuitable because of the poor service life of austenitic welds; (3) the material should be seamless to minimize welding, since many of the difficulties encountered were associated with welding; and (4) resistance to carburization and decarburization was considered of paramount importance. Metallurgical examination of numerous specimens indicated that carburization was restricted to 4-6 per cent Cr, ½ per cent Mo steel only, where recycle gas was handled. Particular significance was assessed to these observations:

(a) Chromium and molybdenum are both carbide formers and confer certain influence on steel. Chromium increases the rate and depth of carburization by affecting the diffusion rate. Molybdenum acts in the same manner but to a lesser extent.

(b) Although carburization is known to occur well below crystallographic transformation temperature (approximately 1,500° F. for 4-6 per cent Cr, ½ per cent Mo), it had never been observed to occur at the temperatures under consideration, i.e., 860°-1,050° F.

(c) The rate of carburization was ap-





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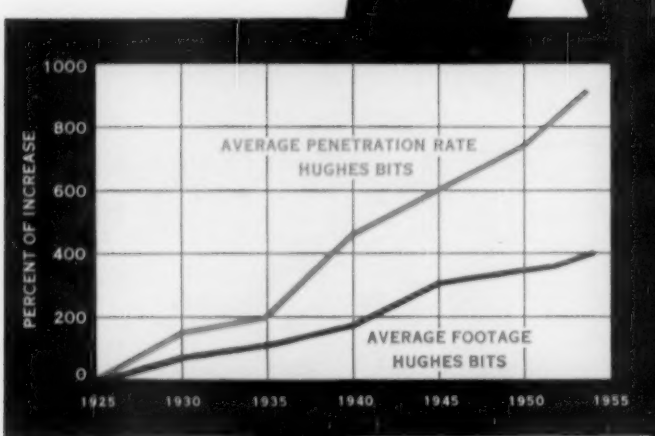
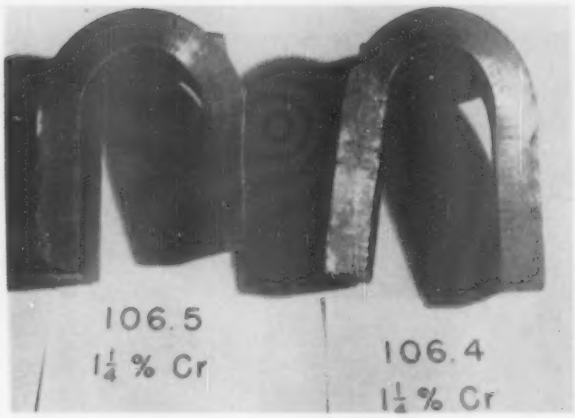




BEND SPECIMENS: 1¼ per cent Cr, ½ per cent Mo (unwelded), showing the excellent ductibility of this material after 3 years of service. Inside of pipe is in tension, Fig. 3.

BEND TEST SPECIMENS: (Weld root in tension) welded with 25-20 Cr-Ni and 1¼ per cent Cr-Mo. Base material is 1¼ per cent Cr, ½ per cent Mo steel. Fig. 4.

preciably greater at the higher temperatures (1,050° F. max.) encountered.

(d) It appeared that the carburizing effect of the methane in recycle gas overbalance the decarburizing effect of the hydrogen. Recycle gas analysis was:

H_2—53-70 mole per cent
C_1—15-22 mole per cent
C_2—6-12 mole per cent
C_3—5-7 mole per cent
C_4—2-3 mole per cent
C_5—2-4 mole per cent

Material selection . . . The problem at hand, therefore, was the selection of a commercial material which (1) would satisfactorily resist the carburizing effect of methane, (2) would resist the decarburizing effect of hydrogen, (3) had adequate high-temperature strength and creep properties, (4) was readily weldable, and (5) was easily obtainable.

After due deliberation, a fine-grained, 1¼ Cr-½ Mo steel (A.S.T.M. Specification A-158-46T, Grade P-11) was selected. Inasmuch as most difficulty had been experienced with welds, all welding was done in strict accordance with a qualified procedure, annealed following fabrication, magnetic-particle inspected, and radiographed.

After several years' service, an investigation was made to determine the condition of the 1¼ Cr-½ Mo material. Samples for investigation were taken with the conventional trepan saw and spherical saw, depending on location, accessibility, etc. Sample locations were recorded in turnaround records, and samples were steel stenciled with a code number which was also stenciled on the line adjacent the point of removal. Eleven samples were removed from these locations:

Sample No.	Sample location	Material	Operating temp., °F.	Operating pressure, psi.
106.0	Line in outlet of B-2 furnace test spool. Two years' service. Boat sample	1½% Cr, ½% Mo	1,050	250
106.1	Line in outlet of B-3 furnace. Three years' service—taken adjacent rewelded plug 106.0. Boat sample	1½% Cr, ½% Mo	1,050	250
106.2	Line in outlet of B-2 furnace adjacent to flange through flange weld	1½% Cr, ½% Mo	1,050	250
106.3	Line moved 1 in. north from 106.2 to obtain more pipe and weld. Boat-shaped sample	1¼% Cr	1,050	250
106.4	Line, 20-in. diameter. Sample was 12-in. diameter disk removed to spud in new reheat coil, B-1 furnace (outlet)	1¼% Cr	990	230
106.5	Line, 20-in. diameter. Sample was 12-in. diameter disk removed to spud in new reheat coil in B-1 furnace (inlet)	1¼% Cr	875	230
109.1	Line, 12-in. diameter. Bottom outlet of D-4 reactor. Two-inch-diameter trepanned plug	4-6% Cr, ½% Mo	878	215 to 220
109.2	Line, 12-in. diameter. Bottom outlet of D-1 reactor. Two-inch-diameter trepanned plug	4-6% Cr, ½% Mo	875	220 to 250
109.3	Line, 12-in. diameter. Bottom outlet jumpover on lead (D-1 and D-2) reactors. Two-inch-diameter trepanned sample	4-6% Cr, ½% Mo	875	220 to 250
109.4	Line, 12-in. diameter. Bottom outlet jumpover, tail (D-3 and D-4) reactors. Sample 2-in.-diameter trepanned plug	4-6% Cr, ½% Mo	878	215 to 220
109.5	Line, 12-in. diameter top jumpover tail reactor (D-3 and D-4). Two-inch. diameter trepanned plug sample	4-6% Cr, ½% Mo	990	230

Note: Wall thickness, ⅜ in.

Outline of tests . . . The following tests were performed: (1) microscopic examinations for microstructural changes; (2) macroetch tests for carburization and soundness; and (3) welding tests on 1¼ per cent Cr, ½ per cent Mo.

Procedure A for the welding tests was: (1) preheat to 400°-600° F.; (2) weld with 2 per cent Cr, ½ per cent Mo electrodes, and particle inspection; (3) inspect by magnetometer particle technique and radiograph weld, and (4) anneal plates.

Procedure B for welding tests was: (1) preheat 400°-600° F.; (2) weld with 25-20 Cr-Ni electrodes; (3) radiograph weld; and (4) anneal plates.

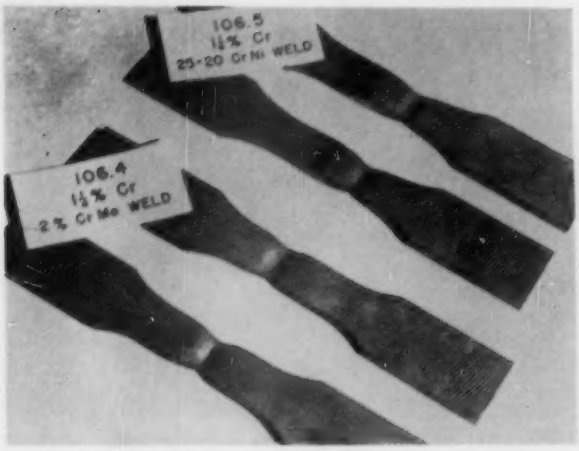
The usual mechanical tests were then carried out on both welded and unwelded samples.

Test Results on New Steel

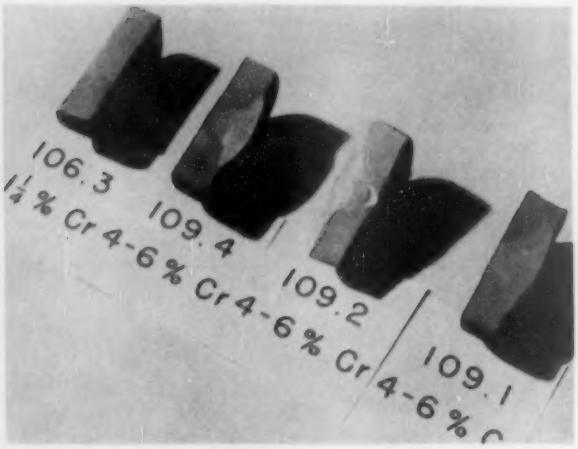
Metallographic specimens of 1¼ per cent Cr, ½ per cent Mo steel Nos. 106.0 to 106.5 inclusive were prepared, polished, and examined for soundness, structural changes, and other information. Specimen No. 106.0, with 15,750 operating hours' service, in recycle-gas service in 1,050° F. showed a total carburization penetration depth of only 0.003 in.

Specimen Nos. 106.1-106.5 with 24,394 operating hours in the same location showed a maximum carburization penetration depth of 0.005 in. (a previous installation of 4-6 per cent Cr, ½ per cent Mo steel in this location showed a carburization penetration depth of 0.187 in 60,500 hours' service). Microstructures otherwise were normal. The slight carburization indicated by the macroetch test was thus confirmed by microscopic examination.

Welding tests were conducted on Samples 106.4 and 106.5. Two procedures, A and B, were used which differed only in type of electrodes. Test A utilized 2 per cent Cr, ½ per cent



REDUCED SECTION TENSILE specimens illustrating failure of 1¼ per cent Cr, ½ per cent Mo steel when welded with 20-20 Cr-Ni. Fig. 5.



MACROETCHED SAMPLES. The 4 to 6 per cent Cr samples show darkened fringe of carburization on the inside surface. Fig. 6.

Mo electrodes, the rod used on unit piping fabrication, and Test B utilized austenitic 25-20 Cr-Ni electrodes. Austenitic steels have generally given unsatisfactory performance in this service, but were tested for (1) record data in the event that emergency repairs were needed, and (2) to provide additional data on the advisability of welding ferritic low-chromium steels with austenitic electrodes, a procedure which has been common practice at Baytown. Data obtained from these tests are in an accompanying table.

Mechanical tests included bend tests with the pipe inside surface in tension, reduced section tensile tests, and hardness determinations (Figs. 3, 4, and 5). Duplicate samples "welded and annealed," and "as received" (24,934 service hours) condition were made where test material quantity permitted. Results of these tests are as follows:

Hardness Tests

Hardness determinations yielded the following results:

Sample No.	Location of test	Hardness
106.0	Parent metal	147 BHN
106.1	Parent metal	150 BHN
106.2	Parent metal	150 BHN
106.4	Parent metal	150 BHN (outside)
		162 BHN (inside)
106.5	Parent metal	150 BHN (outside)
		150 BHN (inside)
106.4W	Parent metal	150 BHN
106.4W	2% Cr, ½% Mo weld	176 BHN
106.5W	Parent metal	150 BHN
106.5W	25-20 Cr-Ni weld	141 BHN
109.1	Parent metal	153 BHN
109.2	Parent metal	150 BHN

Reactor tests . . . Five 4-6 per cent Cr, ½ per cent Mo steel samples were taken from a reactor section operating at 875°-990° F. The samples were bisected, and one-half were macroetched in boiling 50 per cent hydrochloric acid. The remainder were polished for metallographic examination. Minor (1/32-in. max.) carburization observed on all specimens is illustrated in Fig. 6. The 12-in.-diameter pipe from which the samples were taken had approximately 75,900 service hours handling mixed gas in the reactor section.

Conclusions . . . Based on metallographic examinations and test data the following conclusions were made:

1. After 3 years' (24,400 hours) operation in recycle-gas service at 1,050° F., 1¼ per cent Cr, ½ per cent Mo steel piping was observed to carburize to a depth of 0.005 in. This was considerably less than the 4-6 per cent Cr, ½ per cent Mo steel piping previously used.

2. Mechanical properties of the 1¼ per cent Cr, ½ per cent Mo steel piping after 3 years' service were excellent. This conclusion was based on tensile, hardness, and bend tests conducted on the material.

3. Microstructures observed in metallographic examination were considered normal with the exception of minor carburization.

4. Weld tests on 1¼ per cent Cr, ½ per cent Mo steel using two procedures showed it readily welded by either. Procedure B, using austenitic 25-20 Cr-Ni electrodes, showed higher tensile properties and greater elongation than Procedure A, which utilized 2 per cent Cr, ½ per cent Mo electrodes. However, it was not preferred because of the high coefficient of linear expansion of 25-20 Cr-Ni. This was believed to be largely responsible for cracks which previously occurred in welds. The cyclic operation of the system probably magnified the effects of expansion differences.

BEND RESULTS

Specimen No.	Location	Results
106.1	Line, boat-shaped specimen	Bent 180° with pipe inside surface in tension. No defects.
106.4	Line, specimen 2 by 6-in.	Bent 180° with pipe inside surface in tension. No defects.
106.5	Line, specimen 2 by 6-in.	Bent 180° with pipe inside surface in tension. No defects.
106.4W	Welded, Procedure A, 2 per cent Cr, ½ per cent Mo electrodes	Root bend, 180° with no defects.
106.5W	Welded, Procedure B, 25-20 Cr-Ni electrodes	Root bend, 180°. One tear in weld ⅛ in. long.

REDUCED TENSILE TESTS (1¼ PER CENT Cr, ½ PER CENT Mo)

Specimen No.	Yield, psi.	Ultimate, psi.	Per cent elong.	Remarks
106.4-1	40,250	77,800	37.5	
106.4-2	42,500	82,250	37.6	
106.4-3	44,200	77,900	31.3	
106.5-1	49,900	66,500	40.6	
106.5-2	44,200	76,400	40.6	
106.5-3	43,200	77,700	40.6	
106.4-W1	40,200	68,900	18.75	Broke in weld
106.4-W2	38,900	68,500	21.87	Broke in weld
106.5-W1	42,400	75,000	31.25	Broke in plate
106.5-W2	49,700	77,100	32.80	Broke in plate

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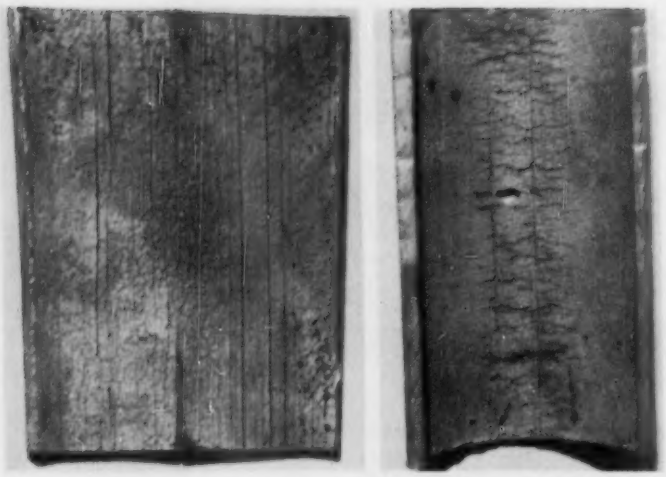

CRACKED TUBE SECTIONS from the primary waste-heat boiler. Cracking was due primarily to corrosion fatigue. Fig. 7.

TYPICAL FISSURE, fatigue-type crack, in the waste heat boiler is shown in this photomicrograph. Fig. 8.

5. After 3 years' service, 1¼ per cent Cr, ½ per cent Mo steel appeared to be an excellent material choice. In addition to fulfilling requirements previously set forth, the material had excellent microstructural stability and extremely low tendency toward formation of graphite. This is due primarily to the development of chromium carbides which resist dissociation to graphite.

6. Minor carburization, 0.031 in. in 75,900 hours, occurred on 4-6 per cent Cr, ½ per cent Mo piping in the reactor region. This was considered mild service as compared to B-2 furnace outlet piping where 4-6 per cent Cr, ½ per cent Mo carburized 0.187 in. in 60,500 hours.

7. These and other tests showed that significant carburization does not appear in the pure naphtha stream, but only in the recycle gas and combined recycle gas and naphtha streams. Carburization rate was reduced in the combined streams and appeared to be a function of proportional mixtures and temperature.

Waste-Heat Boilers

On March 9, 1953, three sections of 2-in. o.d. by 11 BWG carbon-steel tubes, approximately 5 ft. long, were removed from the secondary waste-heat boiler. At the Hydroforming unit, one tube cracked open, and steam from it had eroded a hole in the adjacent tube. The third sample exhibited no major defects.

Hot flue gas formed by coke combustion in the reactors passes through the shell side of the waste-heat boiler and is used in steam generation. A cyclic operation results from pressure variations from 25 to 240 psi. with corresponding temperature variations from 480° to 800° F. three or four times every 24 hours. Water (condensate) entered the tubes at approximately 380° F. and 500 psi. and left at around 480° F. The average life of the tubes over the past 12 years has been about 30 months. The test tubes had been in service 15 months.

Visual examination showed one tube to contain a circumferential crack ½-in. long. The external surface showed circumferential surface striations as well as a sooty black (sulfide) surface coating. The internal surface was relatively clean although there was some adherent scale. Specimens were prepared from the area next to the failure for use in metallographic study.

The second tube failure was obviously the result of steam impingement from the first crack.

Metallographic inspection . . . The metallographic specimens from sample No. 1 were prepared and examined. Numerous wedge-shaped fissures were observed in the external surface, penetrating to a depth of 0.020 in., and filled with a hard, gray corrosion product. Evidence of general external corrosion was observed with 0.100-in. wall thickness remaining. The internal surface was slightly pitted and contained deep (0.025 in.) steep-walled transcrystalline cracks. About 20 such circumferential cracks per inch of tube length were observed on the specimens prepared.

On May 12, 1953, a like failure occurred in the primary waste-heat boiler. One of the five samples submitted for examination contained a small hole, about ⅛ in. in diameter, and through which steam had eroded a hole in a second tube which in turn damaged three more.

Hot (1,100° F.) flue gas entered the shell side of these waste-heat boilers near the top. Preheated condensate entered the tube side also at the top and flowed downward through the 14 water tubes. Flow was reversed at the bottom in the manner of the conventional two-pass exchanger and steam was generated in the remaining 248 tubes during the upflow. On three occasions leaks developed in tubes.

Short sections of the sample tubes were split lengthwise and lightly macroetched to remove all scale. This disclosed many longitudinal, circumferential, and craze crack patterns on the inside surface (Fig. 7), and revealed that the first perforation was caused by erosion from steam escaping through a circumferential crack which penetrated the tube wall. Metallographic specimens showed both the longitudinal and circumferential cracks to be deep, steep-walled transcrystalline fissures filled with a hard, gray scale (Fig. 8). This type of crack is characteristic of corrosion fatigue in boiler equipment.

The fissures in the internal surface of these tube samples were identical to those found in samples submitted on March 9, 1953, from the secondary waste-heat boiler. At that time it was recognized that the cracking was the result of corrosion and cyclic stresses. However, it was believed that the cyclic stresses were of thermal origin resulting from variations in flue-gas temperature.

Examination of the later failures showed that most of cyclic stresses started from a condition within the tube known as "water starvation." This was largely caused by the rapid expansion and contraction of the steel as the result of alternate heating by the flue gas and cooling by slugs of water percolating up the tube. Repeated thermal shock from the 500° F. temperature differential together with slightly corrosive water was enough to cause failure in a short time.

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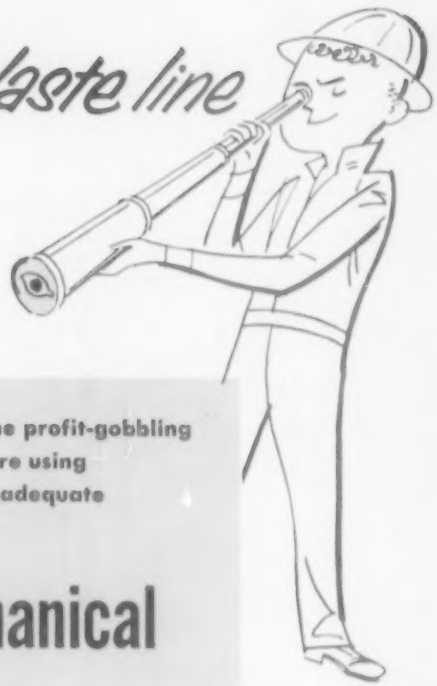

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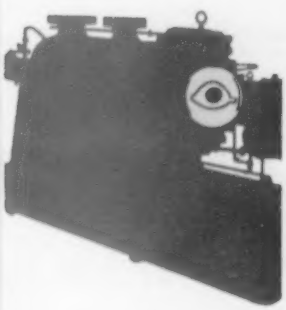

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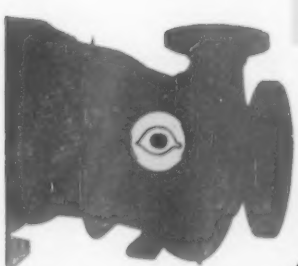

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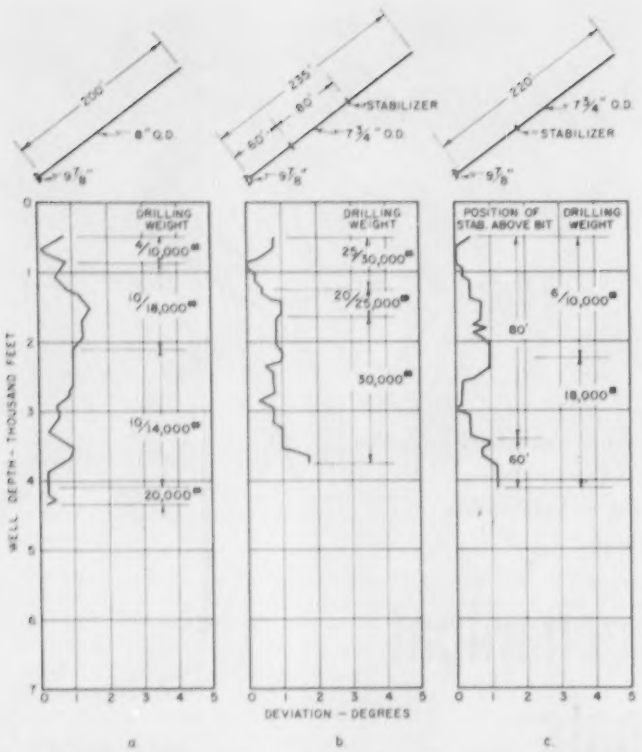
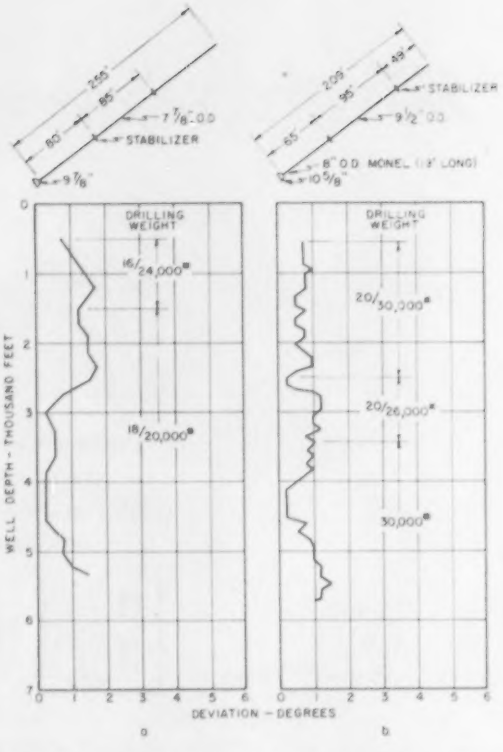


INFLUENCE OF DRILL-COLLAR STABILIZERS on deviation control, Brea field, California. Fig. 8.



EFFECT OF DRILL-COLLAR SIZE on weight on bit to maintain comparable deviation when stabilizers used, Brea field. Fig. 9.

Crooked Holes—And How to Help Them Go Straight

. . . with emphasis on drill-collar size and stabilizers

by John W. Speer and George H. Holliday

Part 2

THE function of stabilizers is to eliminate the deviation tendency caused by weight on bit and to increase the force tending to bring the hole back to vertical. For optimum results, the stabilizers should be placed a certain distance above the bit, depending on the drill-collar size and clearance, weight on bit, and hole angle. Because of the lack of knowledge pertinent to optimum stabilizer position, however, and because field results indicate that the position is not critical, this factor was omitted from consideration in the following discussion (see "Speed Crooked-Hole Drilling," by H. B. Woods and Arthur Lubinski, The Oil and Gas Journal, April 4, 1955, page 215).

The authors are with Shell Oil Co. at Los Angeles and Farmington, N. M., respectively. Paper presented at spring meeting, Pacific Coast district, A.P.I. Division of Production, Los Angeles, under the title, "Influence of Drill-Collar Size and Stabilizers on Deviation Control."

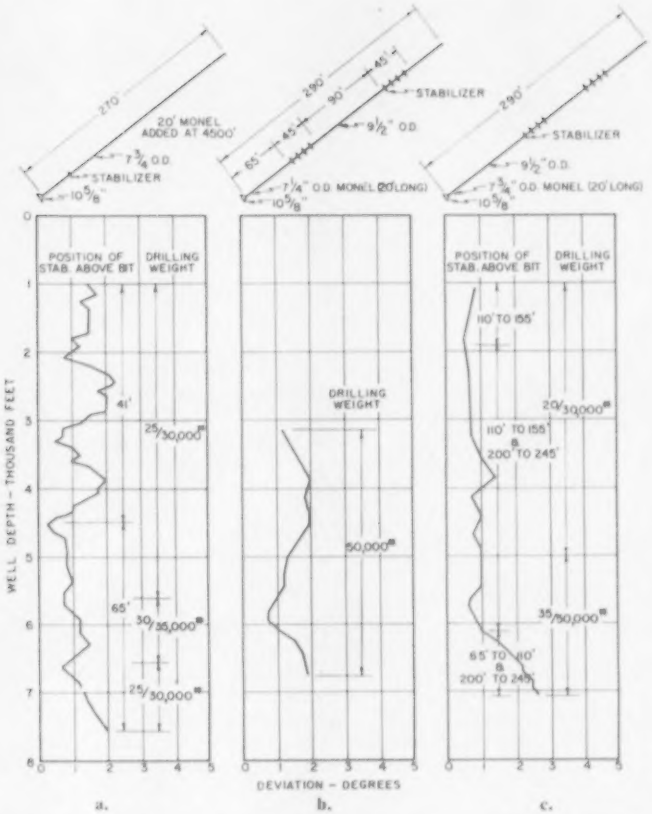
An example of the effect of stabilizers on weight on bit to maintain constant deviation is given in Fig. 8. The comparison is made with data obtained from three wells, two of which were drilled using stabilizers placed at various points in the drill-collar string. Position of stabilizers, drill collar, and hole size, and the drilling weights used are shown for each well.

Figs. 8-a and 8-b show that for an average deviation of approximately 1°, drilling weights on the order of 13,000 lb. were used with the nonstabilized drill collar; whereas weights on the order of 28,000 lb. were used in conjunction with stabilizers. Comparison of Figs. 8-a and 8-c shows that for similar weights the use of stabilizers resulted in approximately one-half the average deviation obtained with the nonstabilized collars.

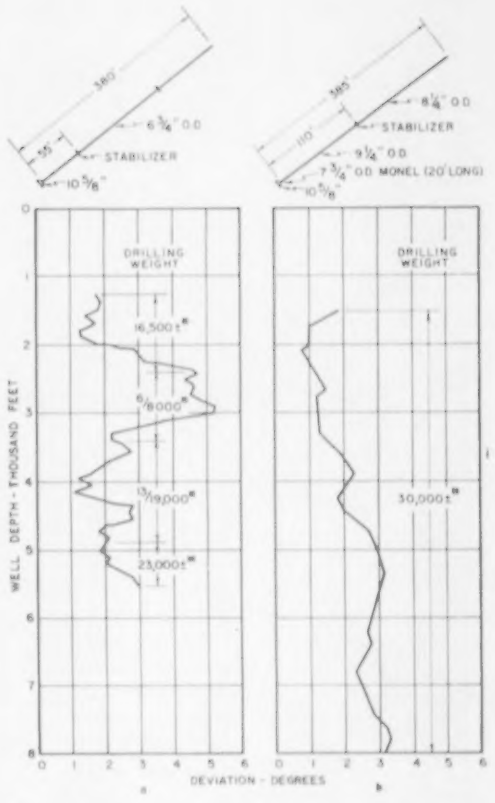
Table 2 gives a summary of data relative to the effect of drill-collar stabilizers. Seven comparisons given show results which vary from no improvement from the use of stabilizers to improvement as great as 115 per cent in weight on bit, with an average increase in weight of 60 per cent.

Drill-collar size—stabilized . . . The effect of drill-collar size on deviation control when using stabilizers is discussed here primarily to add information to the data already developed relative to the influence of collar size. A secondary purpose is to determine if the use of stabilizers alters the effect of drill-collar size as was indicated in the previous general discussion of factors that affect deviation. Comparisons of drilling data which indicate the effect of collar size on deviation tendency are shown in Figs. 9, 10, and 11.

Data given in Fig. 9 show that sim-



EFFECT OF DRILL-COLLAR SIZE on weight on bit to maintain comparable deviation when stabilizers used, Ventura field. Fig. 10.



EFFECT OF DRILL-COLLAR SIZE on weight on bit and hole deviation when stabilizers used, Ventura field. Fig. 11.

ilar hole angles resulted from the use of 26,000± lb. with 9½-in. drill collar and 19,000± lb. with 7⅞-in. drill collar. Fig. 10 shows data obtained from three wells which indicate the influence of drill-collar size on deviation as well as relative drilling weights to maintain comparable deviations. Comparing the results shown in Figs. 10-a and 10-c through the 1,000 to 4,500-ft. interval, an average deviation of approximately ¾° was maintained using 9½-in. drill collars and 25,000± lb. drilling weight as compared to about 1½° average deviation resulting from the use of 7¾-in. drill collars and approximately 27,500 lb. weight on bit.

Through the depth interval 4,500 to 6,000 ft., comparable deviations were maintained using 30,000± lb. with 7¾-in. collars and 40,000 to 50,000 lb. with 9½-in. drill collar. The data given in Fig. 11 for the use of 9¼ and 6¾-in. drill collars show that use of larger collars resulted in lower deviation as well as greater weight on bit.

Although types of stabilizers are not a subject of this report, some explanation is needed for an understanding of the various arrangements discussed. The type of stabilizer with which all results presented herein were obtained is shown in Fig. 12. Essentially it consists of three spiral blades welded to a drill collar or connecting substitute with each blade covering 180° of the collar to insure full-circle contact.

Unless otherwise noted, stabilizer diameter is ¼ in. less than hole size.

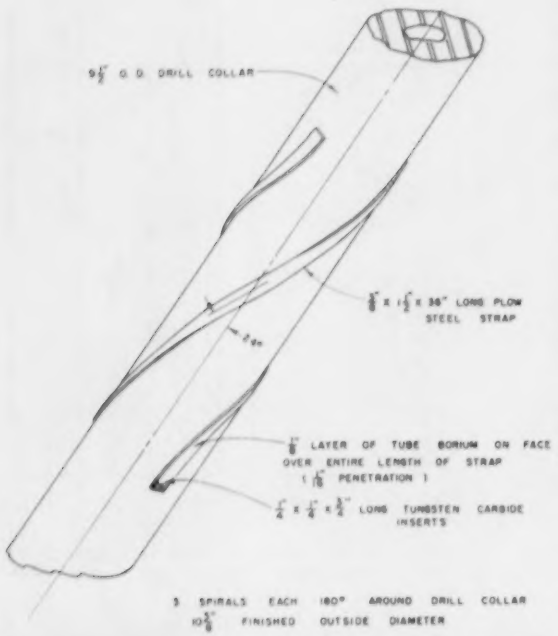
TABLE 2—EFFECT OF STABILIZERS

Field—	Figure or well	Depth interval (ft.)	Hole size (in.)	O.d. drill collars (in.)	Stabilizers O.d. (in.)	Stabilizers Position feet above bit	Average deviation (deg.)	Weight on bit (lb.)	Per cent increase* (or decrease) in weight on bit
Brea	8a	500-3,500	9⅞	8			1	13,000	
Brea	8b	500-3,500	9⅞	7¾	9⅝	60 & 140	1	28,000	115
Brea	A	500-3,500	9⅞	7¾	9⅝	50 & 140	¾	25,000	92
Brea	B	500-3,200	9⅞	7½			½	7,000	
Brea	8c	500-3,200	9⅞	7¾	9⅝	80	½	13,000	71
Brea	C	500-3,000	9⅞	7¾			¾	11,000	
Brea	D	500-3,000	9⅞	7¾	9⅝	80	½	11,000	
Brea	E	2,500-3,500	9⅞	7¾			½	10,500	
Brea	F	2,500-3,500	9⅞	7¾			¾	11,000	
Brea	8c	2,500-3,500	9⅞	7¾	9⅝	80	½	18,000	67
Brea	G	500-1,600	9⅞	7¾			1	12,000	
Brea	H	500-1,600	9⅞	8	9⅝	60 & 120	1	15,000	25
Brea	I	500-1,600	9⅞	8	9⅝	66 & 156	¾	18,000	50
Average per cent increase in drilling weight									60

*Per cent improvement resulting from use of stabilizer.

TABLE 3—INFLUENCE OF COLLAR SIZE—STABILIZED

Field—	Figure or well	Depth interval (ft.)	Hole size (in.)	O.d. drill collars (in.)	Stabilizers O.d. (in.)	Stabilizers Position feet above bit	Average deviation (deg.)	Average weight on bit (lb.)
Brea	9a	500-5,000	9⅞	7⅞	9⅝	80 & 165	1	19,000
Brea	9b	500-5,000	10⅝	9½	10⅜	65 & 160	1	26,000
Ventura	10a	5,000-6,000	10⅝	7¾	10⅜	65	1	30,000
Ventura	10b	5,000-6,000	10⅝	9½	10⅜	65-110 & 200-245	1	50,000
Ventura	10c	5,000-6,000	10⅝	9½	10⅜	110-155 & 200-245	1	42,500
Ventura	C	3,500-5,500	10⅝	6¾	10⅜	55	2½	18,000
Ventura	D	3,500-5,500	10⅝	6⅞	10⅜	42, 133, & 180	2½	25,000
Ventura	E	3,500-5,500	10⅝	9¼	10⅜	110	2½	30,000


9½" O.D. DRILL COLLAR
⅜" X 1½" X 36" LONG PLOW STEEL STRAP
⅛" LAYER OF TUBE BORIUM ON FACE OVER ENTIRE LENGTH OF STRAP (⅛" PENETRATION)
¼" X ½" X ½" LONG TUNGSTEN CARBIDE INSERTS
3 SPIRALS EACH 180° AROUND DRILL COLLAR
10⅝" FINISHED OUTSIDE DIAMETER

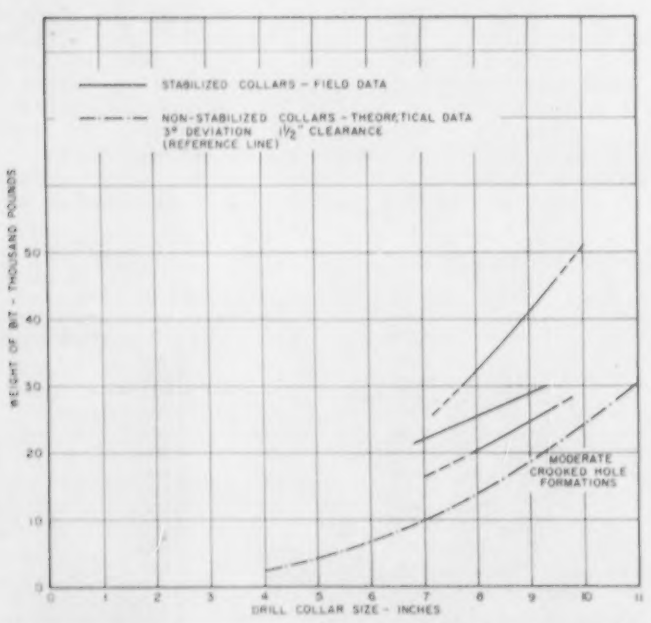
WELDED-BLADE-TYPE STABILIZER for 9½-in. o.d. drill collar. Fig. 12.

The stabilizer arrangement shown in Figs. 10-b and 10-c consists of four of these stabilizers welded on a drill collar at 10±-ft. intervals.

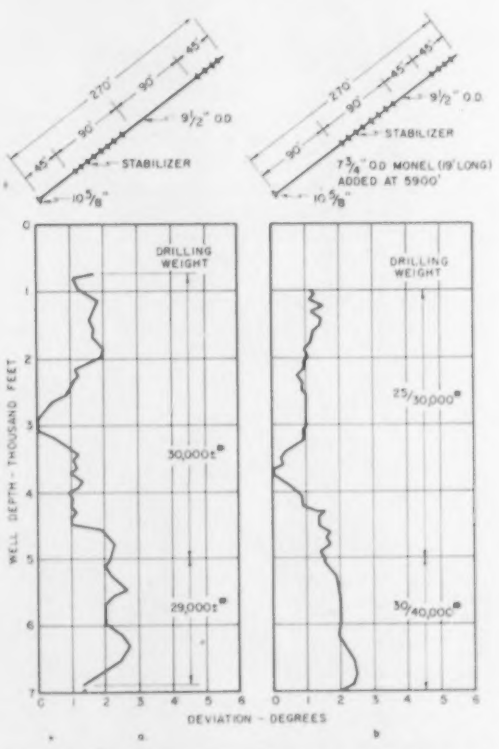
A summary of data relative to the effect of size of stabilized drill collars on weight on bit to maintain a constant deviation is given in Table 3. Using these data, a comparison is made with calculated influence of size of non-stabilized drill collars in Fig. 13. The reference curve depicting the influence of non-stabilized drill collars appears in Figs. 2 and 7 with the same designation as to crooked-hole tendency.

According to these results, the influence of collar size is less when stabilizers are used; weight on bit to maintain a constant deviation is indicated to vary approximately as the 1.5 power of drill-collar diameter when using stabilizers, as compared to the 2.5 power of drill-collar diameter when stabilizers are not used. Considering that for the condition of no stabilizer, the angle of application of weight on bit as well as the straightening force vary with collar size, whereas only straightening force varies with size of stabilized drill collar, a difference in influence could be expected.

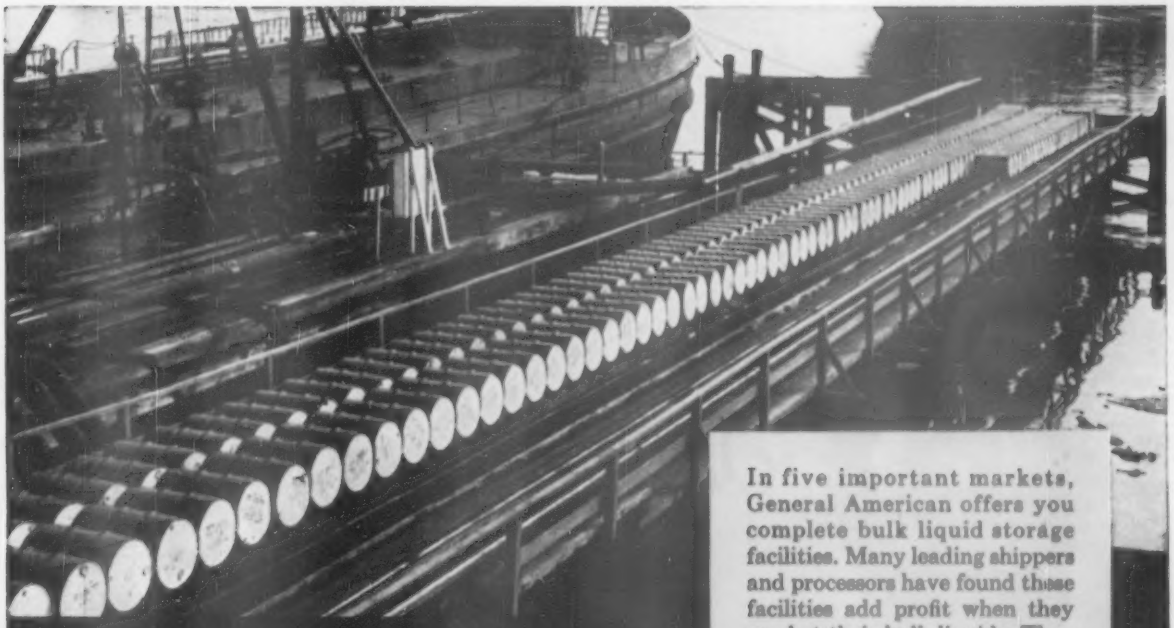
However, more data than presented here are required to establish the magnitude of variance. It is interesting to note also through comparison of field data in Figs. 7 and 13 that in general the weights used with stabilized drill


STABILIZED COLLARS – FIELD DATA
NON-STABILIZED COLLARS – THEORETICAL DATA
3° DEVIATION 1½" CLEARANCE
(REFERENCE LINE)
MODERATE CROOKED HOLE FORMATIONS
WEIGHT OF BIT – THOUSAND POUNDS
DRILL COLLAR SIZE – INCHES

COMPARISON OF EFFECT of collar size of stabilized and nonstabilized drill collars. Fig. 13.



EFFECT OF STABILIZER POSITION on deviation control —45 ft. vs. 90 ft. Fig. 14.



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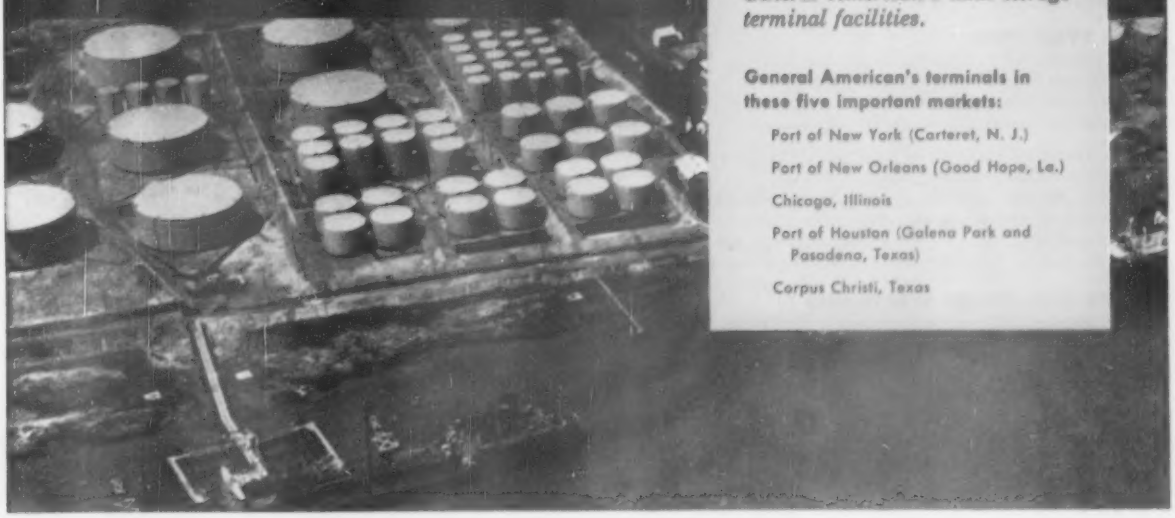

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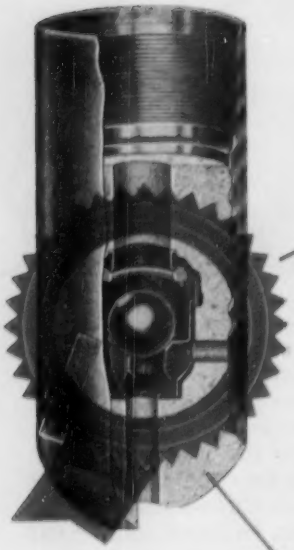

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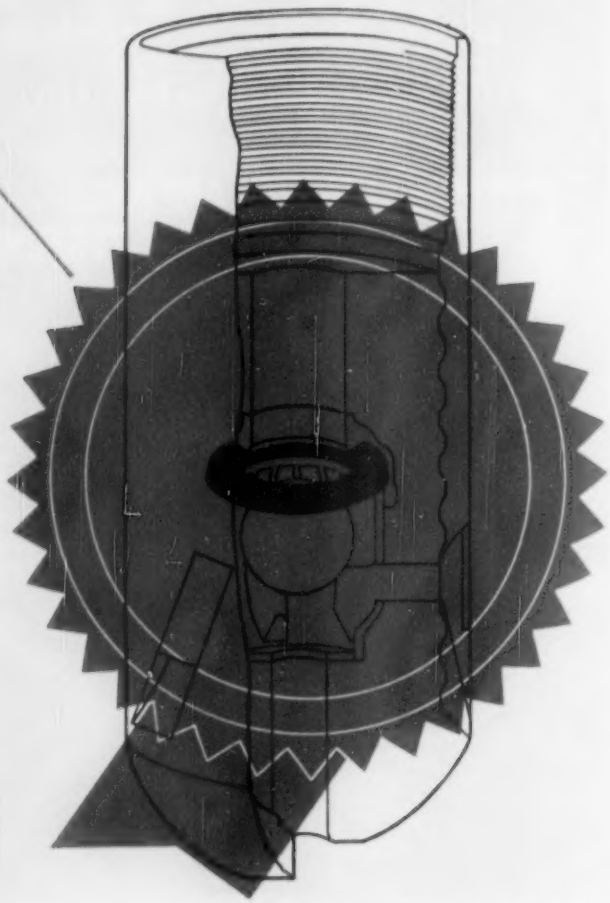

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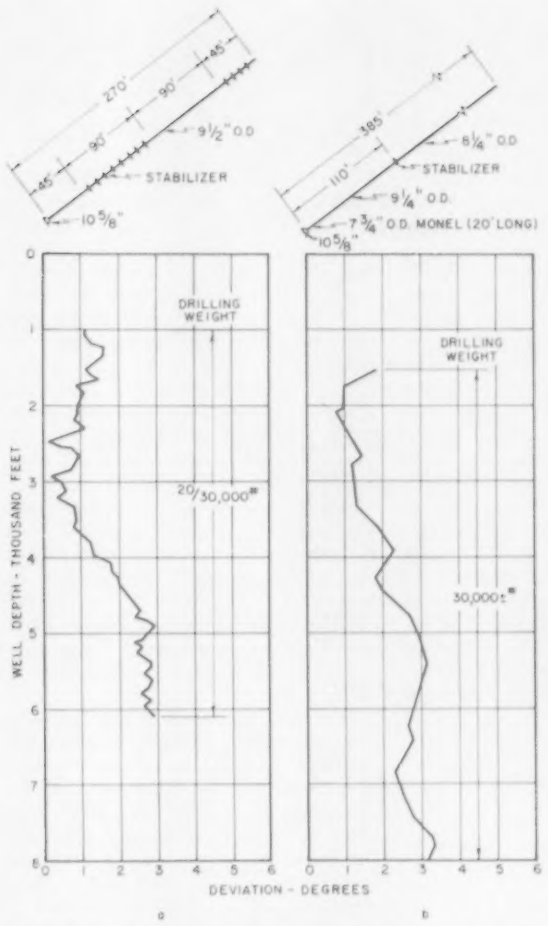
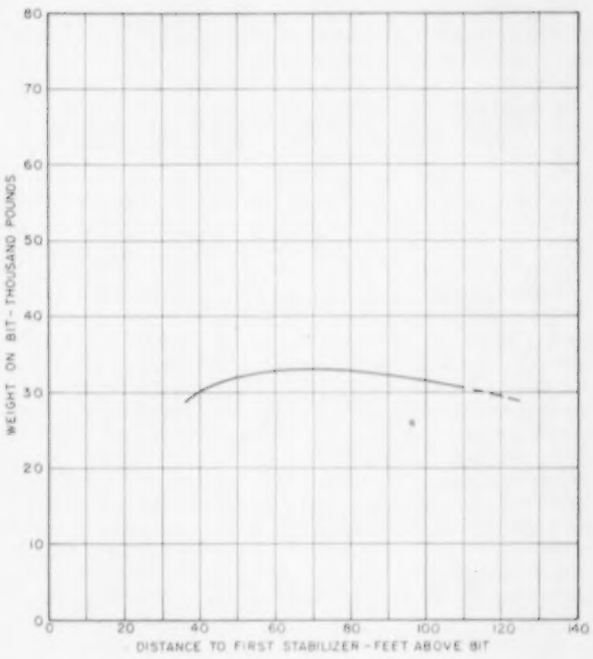


EFFECT OF STABILIZER POSITION on deviation control—45 ft. vs. 110 ft. Fig. 15.



OPTIMUM STABILIZER POSITION (field data: 9½-in. drill collars; 10⅝-in. hole; multiple stabilizers; 1° to 2° deviation)—Ventura field. Fig. 16.

collars were greater than those used with nonstabilized collars. Since many of these data were obtained from the same fields, this further substantiates that drilling weight can be increased through the use of stabilizers.

Stabilizer Position

Data comparisons given in Figs. 14 and 15 were developed to show the effects of various stabilizer positions on deviation control. The figures consist of deviation plots of wells drilled with various stabilizer arrangements, with arrangements and other pertinent information shown for each well.

Where multiple stabilizers were used, position of stabilizer is considered to be the distance from the bit to the first stabilizer above the bit. Fig. 14 shows results obtained using 9½-in. drill collar with stabilizers placed 45 and 90 ft. above the bit, respectively. Considering small differences in deviation and drilling weights, a slight advantage is indicated for the 90-ft. position.

A similar comparison for the positions 45 and 110 ft. above bit, shown in Fig. 15, indicates that the effects

TABLE 4—STABILIZER POSITION

Field—	Figure or well	Depth interval (ft.)	Hole size (in.)	O.d. drill collars (in.)	Stabilizers O.d. (in.)	Stabilizers Position feet above bit	Average deviation (deg.)	Average weight on bit (lb.)
Ventura	14a	1,000-5,000	10⅝	9½	10⅜	45-135° & 235-270°	0-2	30,000
Ventura	14b	1,000-5,000	10⅝	9½	10⅜	90-180° & 235-270°	0-1½	27,500
Ventura	14a	5,000-6,000	10⅝	9½	10⅜	45-135° & 235-270°	2¼	29,000
Ventura	14b	5,000-6,000	10⅝	9½	10⅜	90-180° & 235-270°	2	35,000
Ventura	15a	1,000-6,000	10⅝	9½	10⅜	45-135° & 235-270°	½-2¾	25,000
Ventura	15b	1,000-6,000	10⅝	9¼	10⅜	110	1-3	30,000
Ventura	10b	5,000-6,000	10⅝	9½	10⅜	65-110° & 190-235°	1	50,000
Ventura	10c	5,000-6,000	10⅝	9½	10⅜	110-155° & 200-245°	1	42,500
Ventura	F	2,000-4,000	10⅝	9½	10⅜	65-145°	2¾	30,000
Ventura	G	2,000-4,000	10⅝	9¼	10⅜	90-180° & 235-270°	2½	30,000
Ventura	H	2,500-5,500	10⅝	9½	10⅜	90-130° & 235-275°	1¾	35,000
Ventura	I	2,500-5,500	10⅝	9½	10⅜	45-135° & 235-270°	1¾	35,000
Ventura	J	1,500-5,000	10⅝	8⅛	10⅜	88	3	25,000
Ventura	K	1,500-5,000	10⅝	8⅛	10⅜	113 & 205	1½	28,000
Ventura	L	3,500-5,500	10⅝	6¾	10⅜	55	2	18,000
Ventura	M	3,500-5,500	10⅝	6⅞	10⅜	42, 133, 180	2½	25,000
Brea	8b	500-3,500	9⅞	7¾	9⅝	60 & 140	¾	28,000
Brea	8c	500-3,500	9⅞	7⅝	9⅝	60 & 140	¾	25,000
Brea	8c	500-3,500	9⅞	7¾	9⅝	80	¾	13,000

*Stabilizers evenly spaced in this interval.

of these positions are comparable. Referring to Figs. 10-b and 10-c, previously discussed in connection with the effect of drill-collar size, results obtained through the interval 5,000 to 6,000 ft. with stabilizers placed 65 ft. and 110 ft. indicate a small advantage in weight on bit for the 65-ft. position. Results from 8-in. drill collars with stabilizers placed 60 and 80 ft. above the bit, shown in Figs. 8-b and 8-c, indicate an advantage for the lower stabilizer position.

A summary of information relative to the effect of stabilizer position is given in Table 4. Referring to data for drill-collar sizes of 6¾ to 8⅛ in., there is not sufficient correlation to indicate an optimum stabilizer position. It is indicated, however, that the use of multiple stabilizers resulted in better deviation control than a single stabilizer. In each of the three comparisons given, single-point stabilizations regardless of position resulted in either higher deviations or the use of less weight on bit.

Fig. 16 shows the relationship between weight on bit and position of stabilizer for results obtained from the use of 9½ ±-in. drill collars in 10⅝-in. hole. Since these results were obtained from the same field and represent approximately comparable conditions, weight on bit is shown relative to position of stabilizer in feet above bit. It is indicated that for drilling weights of 30,000 to 35,000 lb., optimum stabilizer position is approximately 70 ft. above the bit. Position of the stabilizer does not appear critical, however, as weight on bit decreases less than 10 per cent for positions as much as 30 ft. either side of optimum.

Assuming that a stabilizer placed near the optimum position results in a 60 per cent increase in weight on bit over nonstabilized drill collars, 22,000± lb. could be used under the conditions shown in Fig. 16 when the stabilizer became ineffective. It appears that this would occur with a stabilizer position farther than 140 ft. above the bit, or twice the optimum. Considering positions below optimum, experience in directional drilling has led to the use of stabilizers (reamers) 2 to 8 ft. above the bit in order to obtain excessive deviations or rapid increase in deviation. Thus, placing a stabilizer too near the bit causes an adverse effect on deviation.

TABLE 5

Hole size (in.)	O.d. drill collars (in.)	Weight on bit (lb.)	Stabilizer position ft. above bit
6	4¾	20,000-30,000	30
8¾	7¼	35,000	45 to 60
9⅞	8	20,000-30,000	60
10⅝	9½	35,000-50,000	65 to 90

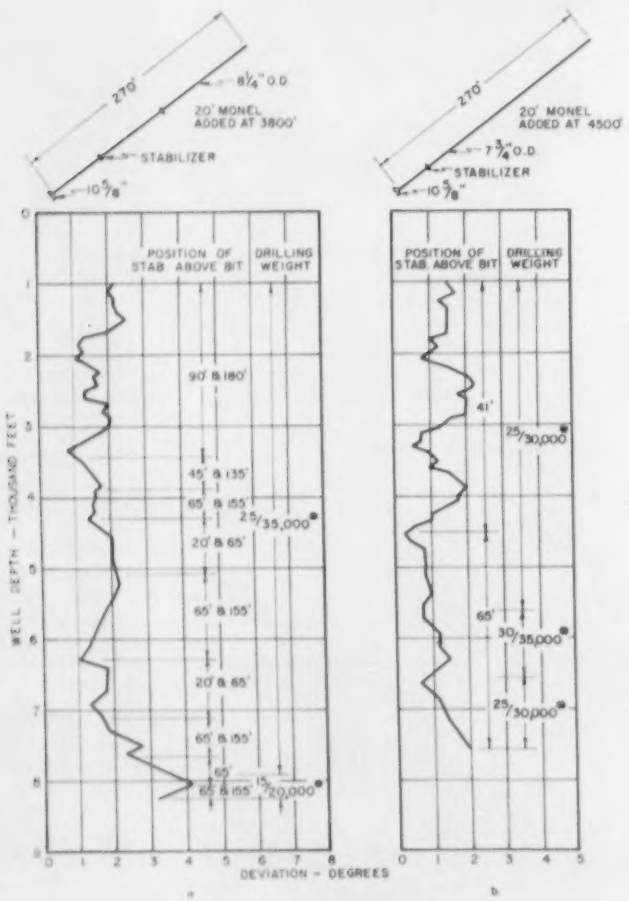
Data developed in Fig. 17 when analyzed in detail indicates the effect of a stabilizer too near the bit. The two deviation records shown were obtained from wells spudded 100± ft. apart and drilled using approximately comparable drill-collar sizes (8± in.). Considering the interval 1,000 to 3,400 ft., similar deviation angles were incurred with comparable drilling weights and stabilizer positions of 90 and 41 ft. above the bit, respectively; this is commensurate with results shown in Fig. 16.

The data presented in Fig. 16 show the relationship between position and stabilizer and weight on bit to maintain a constant deviation for specific conditions, that of 9½-in. drill collar, 10⅝-in. hole, 1° to 2° deviation, and 30,000 to 35,000 lb. weight. Optimum position should vary with each of these conditions; that optimum position is not more critical appears incongruous.

However, it is known that bore holes tend to spiral slightly and that changes in formation cause small imperfection in the hole. Consequently, the actual or drift diameter of a 100±-ft. section of a hole probably is somewhat different from bit diameter, and also probably varies over short intervals of the hole. For these reasons, optimum stabilizer position probably varies appreciably over short intervals also, and a stabilizer in any position is ineffective or deterrent to maximum straightening influence at times. If this occurs, then clearance between the wall of the hole and the deflected drill collar below the stabilizer must be added to the list of defining conditions.

As this clearance varies inversely as distance to the stabilizer, while straightening force varies directly, the opposing influences could extend the range of stabilizer placement for maximum effect. Satisfactory stabilizer positions for various conditions probably can be selected reasonably well through use of Fig. 16.

As an additional guide data relative to stabilizer positions which have produced satisfactory results might be useful. These are shown in Table 5.



EFFECT of stabilizer near bit. Fig. 17.

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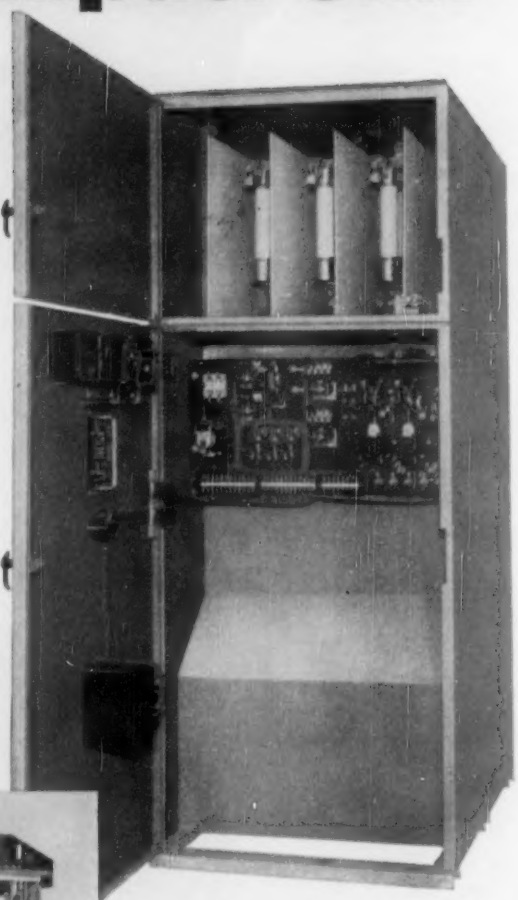

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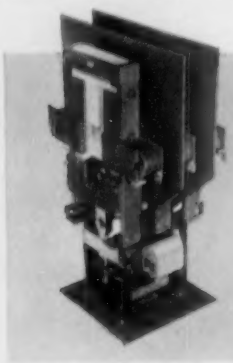

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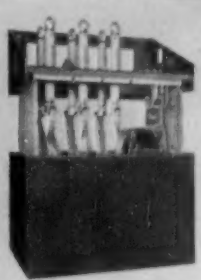

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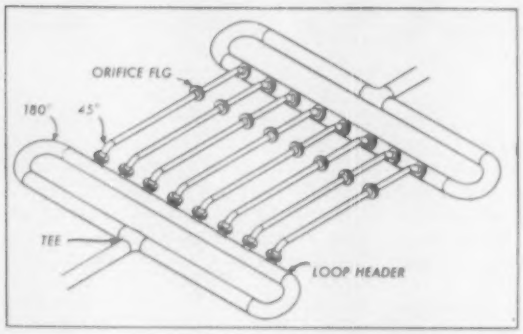
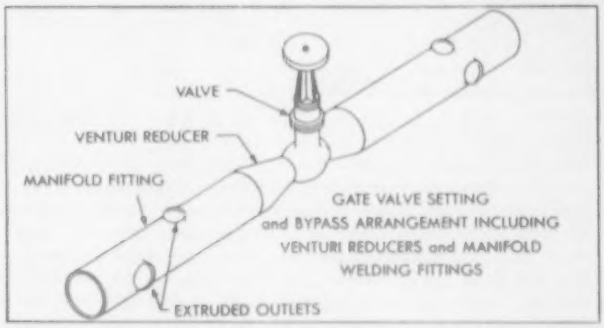


AS METER-RUN LOOP HEADERS requiring multiple-outlet connections, manifold welding fittings do a good job.



IN PIPELINE VALVE SETTINGS, blowoffs, and bypass headers, these fittings can improve construction, especially on cross-country lines.

In comparison with fabricated branch connections, here's

Where manifold welding fittings apply

by Edward F. Harrington

THE manifold welding fitting with integrally forged outlets is a rather new piping component. But it is now being used in increasing quantities in the petroleum industry where high-pressure-service conditions are present. It is expected eventually to largely replace fabricated branch connections in critical installations.

Author is with Tube Turns, Inc., Louisville, Ky.

This new product is used primarily where multiple small outlets are required on a single run, where such outlets must be closely spaced, and where they must be positioned at various points around the run.

The manifold welding fitting has many advantages over conventional fabricated branches. Some of the advantages are: (1) absence of stress concentrations; (2) provisions for better flow conditions; (3) easier installation; (4) greater safety; and (5) often, less cost.

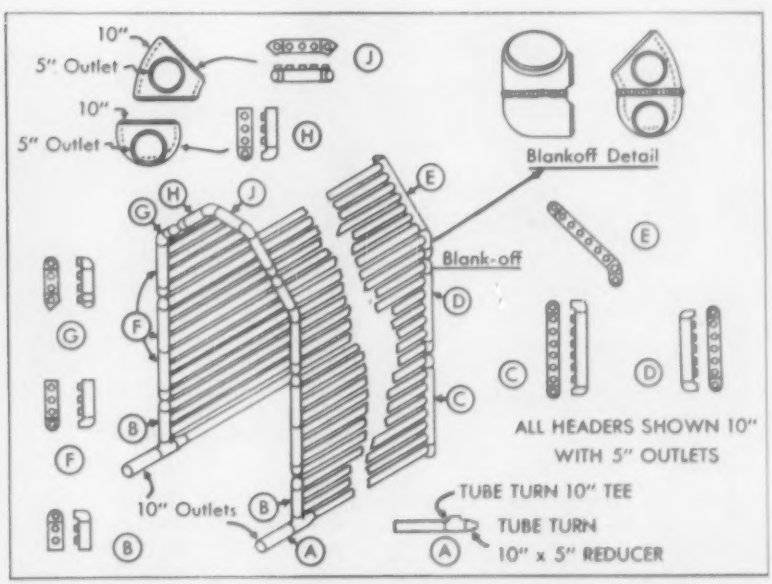
Let's consider some of these advantages in detail.

Absence of stress concentrations . . . The fact that outlets integrally drawn provide connections relatively free of stress concentration is obvious to the experienced designer. He knows that the smoothly contoured, gentle transition from header to outlets results in a minimum notch effect. This has been proved in laboratory tests and field applications.

On the other hand, virtually all reported failures of fabricated branch connections indicate that stress concentration was present, and that the failures originated at discontinuities where pads, saddles, reinforced nozzles, and the like had been welded on to the header or run pipe.

Hydrostatic burst tests indicate that little difference will be found between the fabricated and the integrally forged branch outlets if both are properly made because the high stress concentration in fabricated connections is usually relieved by local yielding. Most failures can, therefore, be associated with cyclic stresses. And, there is very little piping that is not subject to such stresses produced by vibration, pressure pulsation, or major pressure and temperature changes.

Fluid-flow conditions . . . In appraising flow conditions, it is apparent again that



AS HEADERS on charge heaters, pipe stills, and furnaces, manifold welding fittings can cut erection time and installation costs, and minimize chances of failure from stress concentrations.

the smoothly contoured outlets of a forged manifold welding fitting cause less turbulence and pressure loss than the sharp corners produced by any known method of fabricating branch outlets.

The manifold welding fitting is quite versatile in application and can be used advantageously in many piping systems. It is being employed in the construction of such varied equipment as cooling-tower headers; compressor-station suction and discharge bottles; pipeline valve blowoff and bypass headers; surge drums; charge heaters, pipe stills, and furnace headers; equipment headers; meter installations; exhaust manifolds; power-plant headers; and drip-connection manifolds.

Ease of installation . . . One of the most appreciated advantages of the manifold welding fitting is the ease with which it may be installed in a piping system. There are no holes and pads to cut nor pipe nipples to shape. Only a single butt-weld is required to make a sound, trouble-free joint.

In addition, the piping is easy to insulate and presents the pleasing appearance for which plant designers strive. Finally, a butt-weld is generally considered much more reliable than the groove and fillet welds used in installing fabricated branch connections.

That's why the manifold welding fitting has much to offer the designer who is specifying fittings for severe piping service. Its greater fatigue strength, better flow conditions, and ease of installation make this type of fitting worthy of careful consideration.

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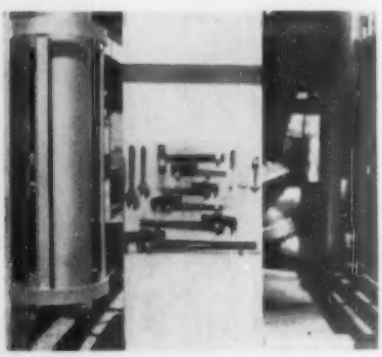
Method suggested by Claude A. Phillips and Robert H. Holmes, helpers, Humble Oil & Refining Co., Baytown, Tex.



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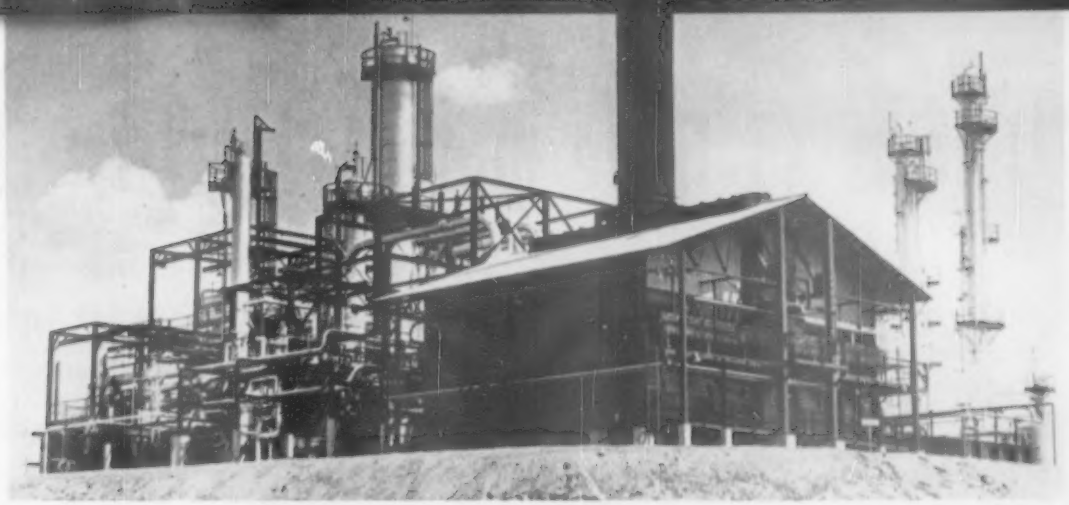


WORLD'S FIRST commercial Ultraforming unit at Pan-Am Southern Corp.'s El Dorado, Ark., refinery operates on a highly paraffinic naphtha. Ultraforming converts paraffins.

How First Ultraformer Has Performed

El Dorado unit upgrades a highly paraffinic naphtha, operates at plus 95 research octane level

by R. R. Gumaer and L. L. Raiford
Pan-Am Southern Corp.

THE world's first Ultraformer, located at Pan-Am Southern's El Dorado, Ark., refinery, has been in successful operation since May 24, 1954.

The unit upgrades a highly paraffinic naphtha. This type of naphtha is considered one of the most difficult to reform, but the unit has operated at octane levels in excess of 95 research clear.

This performance demonstrates the merits of low-pressure reforming, periodic regeneration, and the new Ultraforming regeneration technique. Details of operation at El Dorado to date are described here.

1. Cat Reforming at Lower Pressure

With the accelerated trend towards higher compression ratios in automotive engines, a number of new catalytic reforming processes have been introduced to raise the octane number of motor fuel.[1] Outstanding among these is Ultraforming.[2] This catalytic reforming process has been developed by Standard Oil Co. (Ind.) to obtain the many advantages of reforming at lower pressures.[3] The process uses a platinum catalyst in fixed beds. These beds are regenerated periodically by a new regeneration technique which completely restores both activity and activity maintenance to that of fresh catalyst.

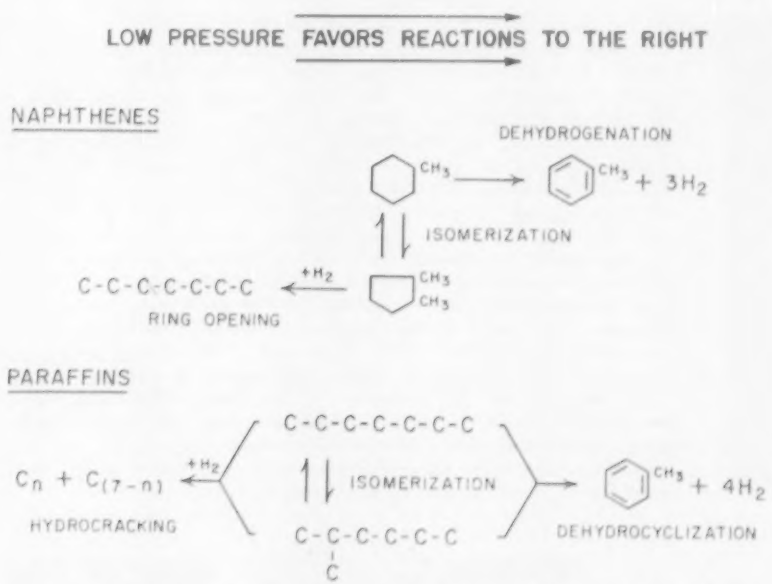
Advantages . . . Low-pressure operation and the Ultraforming regeneration technique offer these four major advantages over conventional platinum-catalyst operation: higher octane numbers; higher gasoline yields; higher effective catalyst activity and yield maintenance; and greater flexibility. Low pressure also gives higher yields of aromatics and byproduct hydrogen.

Ultraforming reactions . . . The principal reforming reactions are:

1. Formation of aromatics from naphthenes.
2. Formation of aromatics from paraffins.
3. Hydrocracking.
4. Isomerization.

These are illustrated in Fig. 1. Of prime importance for octane improvement and high yields are the first two—formation of aromatics from naphthenes and paraffins. These reactions produce hydrogen and are favored by low pressure. This is evidenced by the fact that Ultraforming produces more hydrogen than processes operating at higher pressures.

Hydrocracking minimized . . . Since hydrocracking causes a loss in gaso-



PRINCIPAL REFORMING reactions are formation of aromatics from naphthenes, formation of aromatics from paraffins, hydrocracking, and isomerization. Fig. 1.

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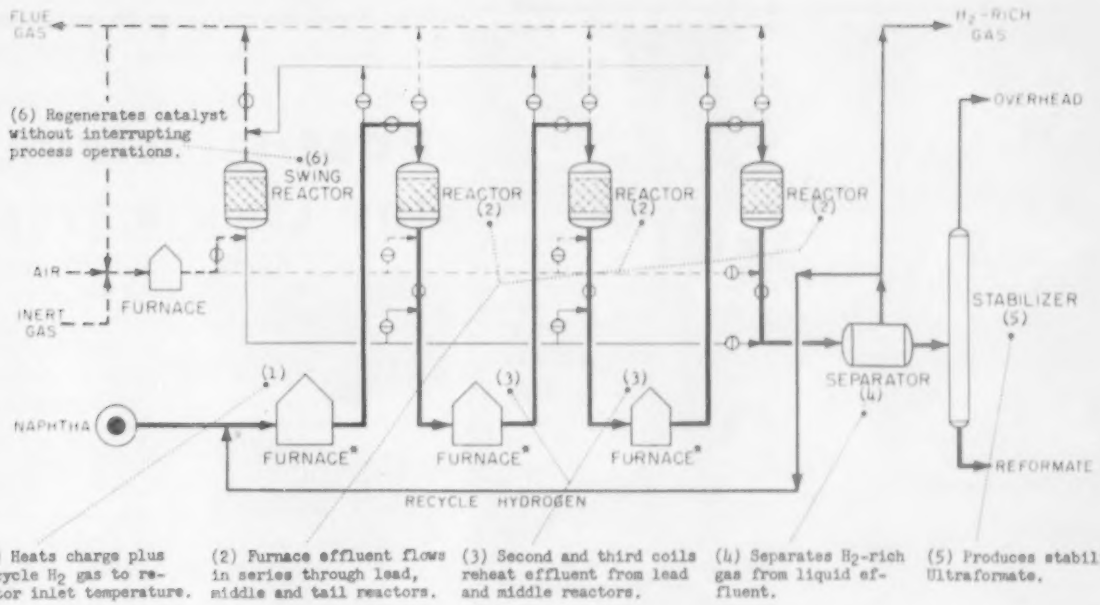

(1) Heats charge plus recycle H_2 gas to reactor inlet temperature.

(2) Furnace effluent flows in series through lead, middle and tail reactors.

(3) Second and third coils reheat effluent from lead and middle reactors.

(4) Separates H_2-rich gas from liquid effluent.

(5) Produces stabilized Ultraformate.

* At El Dorado all three coils are in one furnace.

SIMPLIFIED DIAGRAM of the process flow at the El Dorado refinery. Fig. 2.

line yield and hydrogen production, it is a relatively undesirable reaction. Hydrocracking also increases vapor pressure of the liquid product, thereby reducing the external butanes that can be added.

Low pressure minimizes hydrocracking. This is proved by the fact that Ultraforming, in contrast with processes operating at higher pressures, gives higher gasoline and hydrogen yields, gives lower C_1 through C_3 gas yields, and produces a high-octane product of lower R.v.p., thus permitting inclusion of more vapor-pressuring component in the finished gasoline pool.

2. Pan-Am Southern Unit

Reformer feed at Pan-Am Southern's El Dorado refinery contains about 70 to 80 per cent paraffins and only about 10 to 20 per cent naphthenes. So economic reforming of this naphtha requires that paraffins be converted to aromatics rather than hydrocracked. Ultraforming, which operates at low pressure, effectively accomplishes this.

In the past, increased coke deposits and catalyst deactivation prevented the refiner from obtaining the many advantages of low-pressure reforming. Periodic regeneration by the special Ultraforming technique, which completely restores catalyst activity and activity maintenance, removes this disability. At the same time, it adds an extra degree of flexibility to the process.

Process flow . . . A simplified diagram of the process flow of the El Dorado Ultraformer is shown in Fig. 2. The unit includes prefractionation, reaction, regeneration, and product-recovery facilities. The virgin naphtha feed is prefractionated to remove relatively light ends. Because of the relatively low sulfur content of El Dorado naphtha feed, no desulfurization facilities are required. Design capacity is 6,200 bbl. per stream day reactor charge, although actual throughput now exceeds 7,300 bbl. per stream day. The product recovery section consists of an absorber, stripper, and stabilizer for separation of hydrogen, fuel gas, and Ultraformate.

The swing reactor makes it possible to regenerate without interrupting reforming operations. As shown in Fig. 2, catalyst in the swing reactor is being regenerated while naphtha is being processed in the other three.

3. Performance

Operating conditions . . . The El Dorado Ultraformer operates at a pressure of between 280 and 300 psi. in the lead reactor. The furnaces are designed to provide a maximum reactor-inlet temperature at 970° F., but operations to date have been quite a bit below this temperature. Space velocity has varied in the range of 1.5 to 3.0.

Regeneration . . . As activity of catalyst in a reactor declines within each cycle, product octane level is maintained by increasing the reactor-inlet temperature until (1) the maximum desired furnace-effluent temperature is obtained, or (2) yield declines about 1 to 2 per cent. At this point, that reactor is temporarily isolated from the naphtha process system and is replaced by the swing reactor. Naphtha processing continues while catalyst in the isolated reactor is regenerated with air and inert gas. After regeneration, the reactor is placed back on stream and the swing reactor is available for regenerating another reactor.

Cycle timer . . . The proper sequence of functions required to operate the regeneration cycle is automatically handled by a cycle timer. An interlock

THE AUTHORS

R. R. GUMAER

L. L. RAIFORD

R. R. Gumaer is technical assistant to the vice president of manufacturing, Pan-Am Southern Corp., New Orleans office. A 1937 graduate of Tulsa University with a B.S. in chemical engineering, he started out with Root Petroleum Co. (which later became Pan-Am Southern) in 1937. He has worked continuously for that company since then in various positions, except for 1 year of graduate work at Tulsa University. L. L. Raiford is process engineer at El Dorado refinery. A 1949 chemical-engineering graduate of Louisiana State University, he has worked for Pan-Am Southern since December 1951.

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system prevents one function from starting until the one just preceding it has been completed. Complete regeneration of catalyst in all reactors takes only 72 hours and requires no additional personnel. By means of the cycle timer and electric-driven valves, operating personnel are left free to observe operation of all equipment even during regeneration cycle.

During the past 9 months, the number of catalyst regenerations have been: swing reactor, 11; lead reactor, 13; intermediate reactor, 9; and tail reactor, 8.

Catalyst . . . The present batch of Ultraforming catalyst in the El Dorado unit has been used since September 1954. The catalyst has now attained over 40 bbl. per lb., and it is expected that the catalyst life will equal or exceed 100 bbl. per lb. Samples of the catalyst show that it is in excellent condition. After regeneration by the Ultraforming technique, the activity and yield maintenance exceeds that of fresh catalyst.

Runs to date . . . The El Dorado Ultraformer is now on its third run. The unit was first placed on stream on May 24, 1954, after only about 9 months from the beginning of construction. This first run continued for 118 days with only minor mechanical and operating difficulties. The unit was shut down on September 9, 1954, for a scheduled "exploratory" turnaround. Thorough inspection showed that all equipment was in good condition. Because Ultraforming catalyst, which is supplied by American Cyanamid Co., was not available prior to September 1954, a substitute catalyst was used during the first run as a temporary expedient.

The unit was loaded with Ultraforming catalyst, which had become available at that time, and was placed on stream on September 18, after only 9 days off stream. The second run was stopped on February 28, 1955, for a scheduled shutdown. The third run was begun on March 9, 1955, and is continuing at the present time. Operating factor for the unit is between 90 and 95 per cent. It is believed that an operating factor over 95 per cent can be attained if desired.

Typical data . . . The El Dorado Ultraformer processes an Arkansas naphtha which is considered very poor for reforming operations. Typically, it contains about 70 to 80 per cent paraffins, only 10 to 20 per cent naphthenes, and less than 10 per cent aromatics. Because of the nature of the Ultraforming catalyst and because low pressure favors conversion of paraffins to aromatics, high-octane reformates are obtained with excellent yields. During recent operations, reformates with octane numbers in excess of 95 research clear have been obtained from these highly paraffinic naphthas. Typical yields at the more usual level of operation at El Dorado—85 research octane clear—are presented in Table 1. The yield-octane correlation covering the wide range of operations of the unit to date are presented in Fig. 3.

TABLE 1—ULTRAFORMING YIELDS

Typical reactor charge naphtha:	
A.S.T.M. distillation, °F.:	
I.b.p.	132
10 per cent	178
50 per cent	240
90 per cent	298
F.b.p.	358
Composition, volume per cent:	
Paraffins	71
Naphthenes	20
Aromatics	9
Products:	
C_5+ reformate:	
Oct. No. research, clear	85.0
R.v.p., psi.	6.1
Yield, volume per cent	84.2
Hydrogen, s.c.f./b.	690
10-psi. R.v.p. gasoline:	
Oct. No. research, clear	85.0
Oct. No. plus 3 cc. TEL per gal.	96.5
Yield, volume per cent	91.2

Operating cost . . . The operating force for the El Dorado Ultraformer consists of three operators per shift plus one "day" foreman. A breakdown of operating costs at the current charge rate is summarized in the table below. These costs assume a catalyst life of 100 bbl. per lb. However, should catalyst life exceed this figure, the catalyst cost indicated below would be reduced accordingly.

PROCESSING COST

	Cents/bbl. of charge
Operating labor and supervision (including benefits)	3.8
Maintenance and repairs	2.5
Utilities	7.2
Catalyst	4.0
Miscellaneous	0.3
Total	17.8

4. Some Features

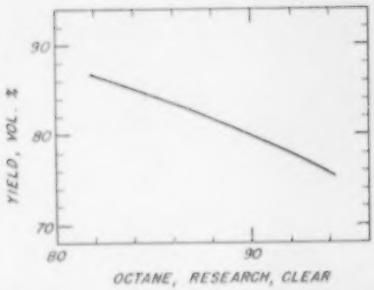
Several features of the El Dorado Ultraformer make the unit easy to operate. These are:

1. Three gas-engine-driven, recycle-gas compressors.

2. A standby reactor.

3. Ability to start up without hydrogen.

During the first year of operation, several operating upsets occurred as a result of power failure and minor mechanical breakdowns. In the case of power failure, no damage to the unit or catalyst resulted because recycle-gas flow was maintained. This prevented furnace overheating and allowed orderly restoration of naphtha flow. When a brief mechanical failure resulted in deposition of carbon deposits on the catalyst, the catalyst was quickly regenerated and returned to peak activity without any appreciable delay.



YIELD-OCTANE correlation covering the wide range of operations of the unit to date. Fig. 3.

Because the Ultraformer can be easily shut down and brought on stream without delay, two brief cleaning and repair jobs were undertaken and completed in about 24 hours each. Because the unit is started up without external hydrogen, no bottled hydrogen or hydrogen storage facilities are required.

Shortly after the start of the second run, excessive pressure drop built up across the reactors. This condition was readily alleviated without shutting down by use of the regeneration facilities. No pressure-drop difficulties have been encountered during the third run.

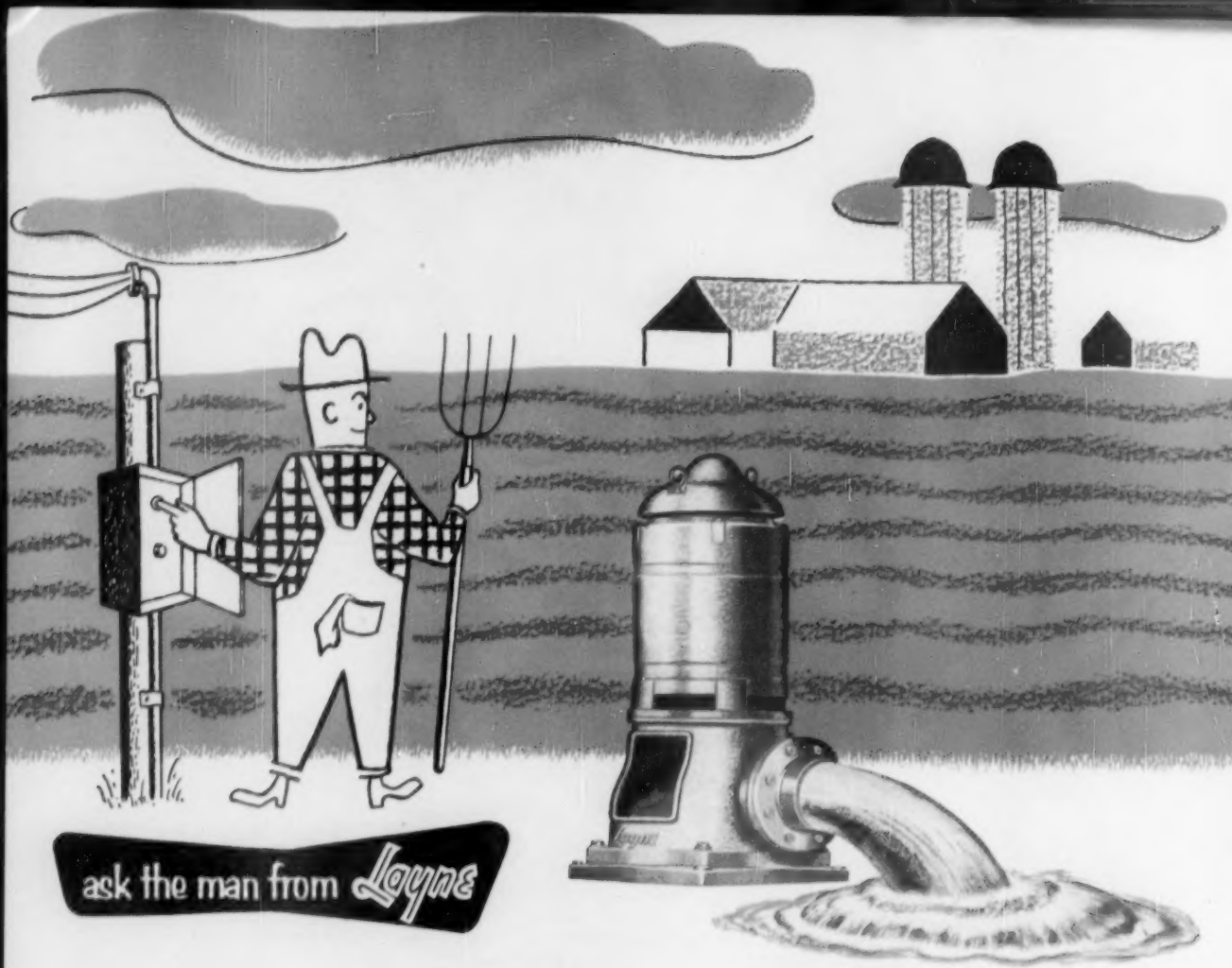
All in all . . . Over-all operations of the El Dorado Ultraformer have been highly successful to date. The higher yields and octane potential predicted by pilot-plant work for low-pressure reforming have been equaled or exceeded in El Dorado commercial operations. Activity and yield maintenance of the Ultraforming catalyst after 40 bbl. per lb. and regeneration by the Ultraforming technique exceeds that of fresh catalyst. Flexibility inherent in the Ultraforming process has been demonstrated by operation over a wide range of conditions. The third run on the world's first Ultraformer is continuing smoothly.

References

1. Steel, R. A., Bock, J. A., Hertwig, W. R., and Russum, L. W., Petroleum Refiner, 33, No. 5, 167 (1954).

2. Birmingham, W. J., Petroleum Engineer, 26, No. 4, C-35 (1954).

3. Forrester, J. H., Conn, A. L., and Malloy, J. B., The Oil and Gas Journal, 52, No. 49, 139 (April 12, 1954); Petroleum Refiner, 33, No. 4, 153 (1954).



. . . then turn on the rain!

Agriculture, Industry and Municipalities—north, east, south and west—are rapidly taking the worry out of weather! Farmers and ranchers, as well as civic engineers and plant operators, are discovering in ever increasing numbers that a controlled, reliable source of water is sound economy.

But a word of warning. Investigate thoroughly. Be sure . . . doubly sure . . . . that the system you install is properly designed for specific needs and definite purposes, for both the present and the future.

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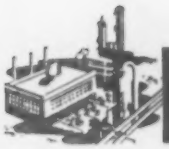


JOB IMPROVEMENT FOR THE PROCESS FOREMAN—16

25 Pointers on Better Burner Operation

1. A thin, fluttery oil fire means too much steam for atomization.

2. A long, smoky flame may be due to improper burner-tip design, insufficient combustion air, or insufficient atomizing steam.

3. A dazzling white oil fire means either too much excess air or too much atomizing steam.

4. An oil burner operating at proper adjustment makes a bright yellow flame which verges on whiteness.

5. A reddish, dusty looking flame with flocks of smoke over the bright part of the flame indicates lack of enough air to burn the fuel.

6. Sparks in the flame may come from a dirty tip, wet steam, solids in the fuel, or water in the fuel.

7. An uneven flame may mean a dirty tip.

8. An oil burner properly adjusted makes a clean flame with no trace of smoke.

9. Failure of ignition may be due to a low fuel pressure, too much atomizing steam, fuel valve plugged, improper design of tip, or wet steam with slugs of water from steam line.

10. Puffing in the furnace may be caused by poor tip design, insufficient excess air, or partial stoppage of burner tip.

11. Operation may be erratic and the flame may sputter at fuel-oil temperatures above the flash point.

12. The higher the temperature of fuel oil, the better the performance—unless premature vaporization occurs or unless water content of the fuel is high.

13. Excessive coking in burner tips may be caused by highly superheated atomizing steam along with a high fuel-oil temperature.

14. Rapid coke formation and refractory deterioration may be caused by excessive flame impingement against the muffle block. This is usually caused by the oil burner being too short, the oil too cold, the flame angle too wide, the oil tip misaligned, too much fuel being burned, too much excess air, or faulty installation of the burner.

15. When firing both oil and gas, more stable and even flames can be maintained by firing both fuels at the same time on the same burners. However, the capacity is slightly lowered by doing this.

16. The flame may be shortened by increasing the primary air, increasing secondary air, or increasing atomizing steam slightly.

17. Flame blowback into a gas burner can be prevented by carrying enough gas pressure.

18. Uneven furnace temperatures may be caused by nonuniform burner flames.

19. When lighting an oil burner, always turn on the atomizing steam first, then open the oil valve slowly until the burner lights.

20. Always use a large torch in place before the fuel is turned on to light burners.

21. Always blow down steam lines before lighting burners.

22. A cold furnace should only be lighted after all air registers and dampers have been opened several minutes, allowing ample time for steam purging to remove through the stack any accumulated gas in the firebox.

23. Be sure that the stack damper is open when lighting a cold furnace; adjust draft with burner air registers.

24. When a burner is not in use, provision should be made to keep from overheating it. This can be done by removing the burner from the furnace, or cooling it with a slight natural draft or a small amount of steam.

25. Keep the amount of excess air at a minimum.

A good understanding of fuel, burners, and combustion principles leads to intelligent, efficient furnace operation.

Courtesy of Phillips Petroleum Co., refining department.

The next series . . .

Starting on this page next week will be a series on chemistry of petroleum. This material is written in the language of the operating man, not in the language of the chemist. The various hydrocarbon series, paraffins, olefins, naphthenes, and aromatics are explained in easy-to-understand terms.

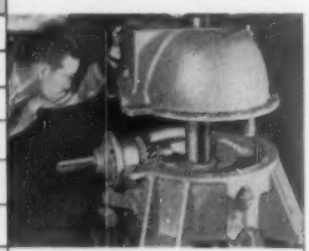
The series outlines the compounds that fall variously in classifications as gases, liquids, or solids and explains their properties. Easy rules are worked out for determining structures of the various compounds in petroleum.

FLUOR -WESTERN SPEED REDUCERS

add years to the mechanical life of cooling towers

Gear reducers which drive the fans in induced draft cooling tower service are located in the exhaust stream and are constantly exposed to the hot, humid and often corrosive vapors coming up through the tower. Gear boxes must be specially designed to withstand corrosion, and operate efficiently and economically for the life of the tower. The built-in superiority of the Fluor-Western power transmission unit is shown in the chart below. The Fluor unit is compared with five competing makes:

The bell-shaped housing on Fluor-Western Speed Reducers is low, wide, and offers a good sturdy support for fan.



Each Fluor-Western Speed Reducer is thoroughly tested for noise level and horsepower rating before leaving the factory.

	FLUOR	A	B	C	D	E
1. Case-hardened spiral gear	yes	yes	yes	yes	no	yes
2. Ratings based on 1.5 AMGA service factor	yes	no	yes	yes	no	yes
3. Straddle mounted pinion gear	yes	no	no	yes	yes	no
4. Webless-type ring gear	yes	yes	no	yes	no	yes
5. B-10 bearing life (in hours)	80,000 to 2,000,000	50,000	20,000	80,000 to 100,000		5,000
6. Condensate trap	yes	no	yes	yes	no	yes
7. Double neoprene seals (input shaft)	yes	no	no	no	no	no
8. Two oil-fill elbows	yes	no	no	no	no	no
9. Efficiency	98%	98%	98%	98%	90-95%	98%

EXPLANATION OF CHART

1. Over the years, case-hardened spiral bevel gears have proved to be far superior to worm gears or flame-hardened bevel gears.

2. The Fluor-Western Speed Reducer is designed and rated in accordance with the applicable standards of the American Gear Manufacturers' Assn. and utilizes a minimum service factor of 1.5 for continuous service.

3. The Fluor-Western pinion is straddle-mounted on heavy-duty bearings. Uniform tooth contact, quieter operation, minimum deflection are the advantages.

4. Deflection tests on ring gears prove conclusively that webless ring gears which utilize a maximum diameter hub are much more rigid than web-mounted gears.

5. Most gear failures are traced to bearing failure. The majority of bearings in the Fluor-Western Speed Reducer have a B-10 life in excess of 100,000 hours. At certain ratios and speeds bearing life can be considered infinite.

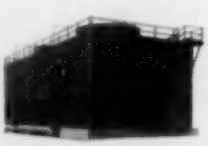
6. A condensate trap collects entrained water inside the gear unit caused by condensation, thus protecting the lower bearing from improper lubrication.

7. Two Neoprene seals mounted back to back on the input shaft, with grease between (to keep foreign matter out and oil in), are found only on the Fluor-Western unit.

8. Only Fluor-Western units have the servicing convenience of two oil-fill elbows; one is piped outside the fan stack for easy filling, the other provides a positive check for proper oil level.

9. Efficiency ratings are based on actual gear mesh loss. Fluor-Western spiral bevel gears average around 1% to 2% loss while competitive worm gears show a loss of 5% or greater.

A COOLING TOWER EVERY 3 DAYS



In the past decade (1944 through 1954) Fluor has built 1,218 induced draft cooling towers throughout the world—**an average of one new tower every three days.** The total number of cells in these towers adds up to 3,138 which represents 3,138 individual gear reducers ranging in sizes from 15 to 100 horsepower ratings. The extra long gear and bearing life of Fluor-Western Speed Reducers is an important factor in the overwhelming preference for Fluor Cooling Towers. The Bulletin, "Cooling Water for Industry," will be mailed on request.

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FLASH VAPORIZATION—3

Plant Results vs. Calculated Data

by G. A. Filak, H. L. Sandlin, and C. J. Stockholm

CORRELATIONS by Edmister and Pollock use volume average boiling point, A.P.I. gravity, A.S.T.M. distillation slopes, A.S.T.M. distillation 50 per cent point, and flash vaporization at 50 per cent point to determine the critical point, a focal point, and a flash vaporization curve at atmospheric pressure.

From the focal-point, lines of constant volume per cent flashed can be drawn through the proper points on the atmospheric flash-vaporization curve to obtain a phase diagram for the stock. These constant volume per cent flashed lines may be extrapolated to any desired pressure. However, all of Edmister and Pollock's correlations are based on experimental flash vaporization at pressures atmospheric or above.

Basis of methods . . . Three of the four methods mentioned use slope and boiling-point correlations to convert an A.S.T.M. or true-boiling-point curve to a flash-vaporization curve. Only Okamoto and Van Winkle's later method establishes a direct relationship between A.S.T.M. distillation, flash vaporization, and flashing pressure.

Authors are with the technical department, refining division, Magnolia Petroleum Co., Beaumont, Tex. Paper presented at second annual joint A.I.Ch.E.-A.C.S. meeting, Sabine area and Texas-Louisiana Gulf chapters, respectively.

All methods use laboratory distillation at atmospheric pressure as a basis for conversion to flash-vaporization temperatures. One reason for this basis is that experimental flashing at low pressures has been carried out on stocks of a boiling range lower than normally flashed on commercial vacuum-distillation units.

Error is introduced by the necessity of correcting a laboratory vacuum-distillation to atmospheric pressure before any of the above methods can be applied to the reduced crude oils tested.

A correlation of laboratory vacuum-distillation temperatures with flash-vaporization temperatures would eliminate any error in correcting a vacuum distillation to atmospheric pressure.

5. Comparing—Calculated vs. Observed

Comparisons of calculated and observed data are shown in Figs. 3, 4, and 5. Fig. 3 compares, by per cent, actual volume of material flashed with calculated volume. In Figs. 4 and 5, the differences between the estimated and observed volumetric percentages of materials flashed are plotted against pressure and percentages flashed, respectively.

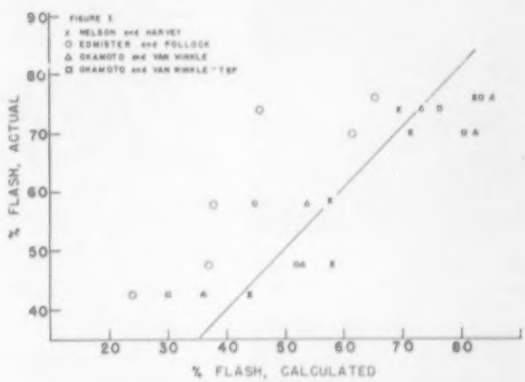


Fig. 4—Difference between calculated and actual volume percentages of material flashed plotted versus pressure.

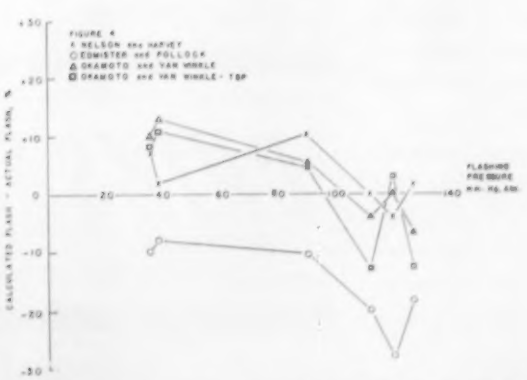


Fig. 3—Comparison, by per cent, of actual volume of material flashed with calculated volume.

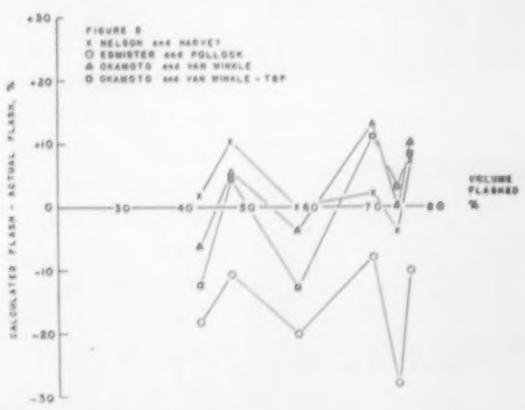
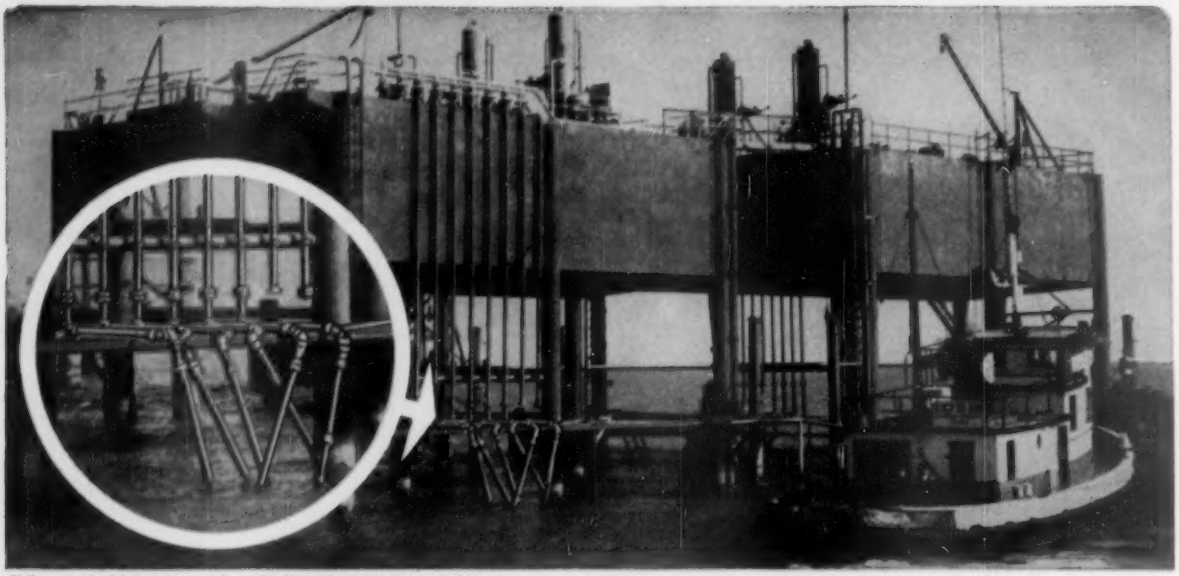


Fig. 5—Difference between calculated and actual volume percentages of material flashed plotted versus percentage flashed.



Chiksan swivel joints are used on the 12 underwater lines on this portable submersible tank battery barge which stores oil from 12 wells. Three swivel joints are used on each line to provide necessary flexibility and safety against storms, wind and waves. Visible in this photograph are style 50 Chiksan joints. Style 10 and style 50 joints are below the surface.

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CHIKSAN *Marine* SWIVEL JOINTS

Each submersible tank battery has a 6" or 8" CHIKSAN aluminum Marine and Barge Loading Hose that permits unloading of oil to the barges.

After 3 years of under-water service this CHIKSAN Marine Swivel Joint has been raised from 14 feet of water 13 miles from shore to service the packing.

Same CHIKSAN joint being cleaned of marine growth after re-packing and preparatory to re-submerging for years more of safe and economical service.

In the bays along the Texas and Louisiana Gulf Coast submersible tank-battery barge storage and transfer of oil has been made both possible and practicable with the application of CHIKSAN Marine Swivel Joints to the under-water flow lines.

In waters that range from 8 to 35 feet deep and with pressures up to 2100 psi. CHIKSAN joints have given the necessary flexibility of flow lines, economy of transport and safety of operation in transferring oil for distances in excess of 13 miles under water without line rupture or loss of product. Tight bends and connections on the flow lines between well platforms, tank batteries, metering platforms or drilling structures in the operation of off-shore locations that could not withstand the "Sunday Punch" of wind, waves and dragging boat anchors, are eliminated by the use of CHIKSAN swivel joints.

CHIKSAN'S special design submersible Marine Swivel Joints have once again solved a costly and perplexing problem of the Petroleum Industry.

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by **W. L. Nelson**
Technical Editor

QUESTIONS ON TECHNOLOGY

References—Handling Viscous Crude Oils

We shall appreciate any references that you may have concerning the handling of viscous oil (your answer of November 15, 1954).—W.F.P.

No references except general ones were used in preparing the Question on Technology of November 15, 1954, page 269, entitled, "How to Handle Viscous Crude Oils." However, there has been significant literature and some of it is listed here along with a word regarding the subject matter:

1. Anon., "Telescopic Hot Oil Lines for Heavy Crudes," Oil Forum, p. 132, 1950. Many California oils (under 20° A.P.I.) are handled by heating to 160°-180° F. (even 220° F.). In 20-30 miles they have cooled to 100° F. Emergency methods of heating when a line freezes are mentioned.

2. Johnson, C. N., "Heat Conductivity of Soil Governs . . . Heated Oil Lines," Pet. Engineer, p. 41, Oct. 1937. A comprehensive discussion of heat losses to the soil.

3. Karge, F., "Design of Oil Pipe Lines, Part 3," Pet. Engineer, p. 76, May 1945. Upon shutdown, a viscous-oil line is plugged out with a lighter oil and when pumping is resumed, the line is warmed before viscous oil is admitted. Santa Maria 14° A.P.I. crude oil cools in the winter from 190° to 120° F. in flowing 16 miles. Various means of heating are mentioned.

4. Karge, F., "Design of Oil Pipe Lines," Pet. Engineer, p. 184, Apr. 1945. A tabulation of soil conductivities and heat transfer rates to soil is presented.

5. Martin, M., "Gulf Experience . . . Pipelining of Highly Viscous Crudes," The Oil and Gas Journal, p. 73, Nov. 29, 1954. Computations for an 88-mile line (oil heated nine times) checked satisfactorily with the actual performance. Viscosity data for Baxterville and Eucutta Mississippi oils. The heat-transfer rates of F. Karge (Ref. 4) were substantiated.

6. Monson, L. T., "The Heat Factor in Treating Heavier California Crude Oil Emulsion," Pet. Engineer, p. B-11, June 1952. Heating saves much expense in the settling of viscous oils.

7. Nelson, W. L., "Cooling Gas by Coils in Ground," The Oil and Gas Journal, p. 51, Oct. 3, 1949. General discussion of the mechanism by which heat is lost to the soil.

8. Nelson, W. L., "Viscosity of Crude Oils," The Oil and Gas Journal, p. 70, Jan. 5, 1946. Effect of temperature on the viscosity of 42 Oklahoma, 4 Illinois, and 7 Wyoming crude oils.

9. Nelson, W. L., "Viscosity at Pipeline Temperature," The Oil and Gas Journal, p. 87, Jan. 12, 1946. Approximation of pipeline temperatures from mean weather temperature. Effect of temperature on the viscosity of 7 Texas and 22 California crude oils.

10. Nelson, W. L., "Viscosity of Various Crude Oils," The Oil and Gas Journal, p. 192, Nov. 8, 1954. Viscosity of crude oils at 100° F. as a function of gravity, including those of California, Mississippi, Coastal, West Texas, Venezuela, and miscellaneous United States oils.

11. Rintoul, William T., "Blending and Heat Solve Heavy-Oil Problem," Pet. Engineer, p. D6, Dec. 1951. San Ardo crude of 11.8° A.P.I. gravity is diluted and also heated to 170° F.

12. Rintoul, William T., "Diluent Injection Aids Heavy-Oil Lift," Pet. Engineer, p. B-42, Feb. 1952. Santa Maria crude of 6° to 9° A.P.I. gravity from a few wells is produced by draining 40-50 bbl. each day of a lighter (21° A.P.I.) crude oil (heated to 150° F.) into each well.

13. Stormont, D. H., "How to Make Viscous Liquids Flow," The Oil and Gas Journal, p. 224, Oct. 4, 1951. Gas oil for blending is pumped to the field from a terminal. The diluted oil is heated to 180° F. before pumping it to the shipping terminal.

14. Stormont, D. H., "Insulating Wash Tanks Pays Off," The Oil and Gas Journal, p. 88, June 2, 1952. Insulation pays for itself within a year on settling tanks operating at 150° F.

15. Stormont, D. H., "Casmalia—0 to 1,700 Bbl. per Day," The Oil and Gas Journal, p. 96, Sept. 27, 1954. Casmalia crude of 9° gravity is produced by using long-stroke well pumps operating at a slow speed. The oil is diluted on the surface with 53° A.P.I. naphtha (or equivalent gas oil) and heated to 185° F. before treating.

16. Walker, E. W., "Down-the-Well Heating," Pet. Engineer, p. B-36c, Dec. 1954. Gas-fired hot water system proves successful for shallow wells producing 12.8° A.P.I. Yorba Linda (California) crude oil. Curve of viscosity versus temperature.

Constant in Salt Equation

In Refiners Notebook No. 29, page 38, (reprint, The Oil and Gas Journal) the following equation appears: 20 ml. 0.0488 N Ag NO_3 = lb. NaCl per 1,000 bbl. I am unable to follow the calculation. Does it mean 20 ml. of silver nitrate?—G.T.Y.

The equation says 20 (a constant) times milliliters of 0.0488 normal silver nitrate equals pounds NaCl per 1,000 bbl. The reaction is:

$$Ag\,NO_3 + NaCl = Ag\,Cl + Na\,NO_3$$

Thus the constant (for a 50-ml. sample) is:

$$\frac{3{,}786}{50} \times 42 \times 1{,}000 \times \frac{0.0488 \times 58.5}{454} \times \frac{1}{1{,}000} = 20$$

in which 3,786 is milliliters per gallon, 454 is grams per pound, and 58.5 is the molecular weight of sodium chloride.

Specs for Lighter Fluid

We are developing a lighter fluid and would like to hear your ideas of same. We are adding a pure hydrocarbon.—F.G.P.I.

The mechanics of lighter operation are so simple that precise specifications are not necessary. The lighter should not smoke, and the wick should not become encrusted. The fluid should have a safely low vapor pressure and its odor should be scarcely noticeable. Light straight-run petroleum naphthas, preferably acid treated and sweetened, would seem to be excellent.

The general properties of such a material would be:

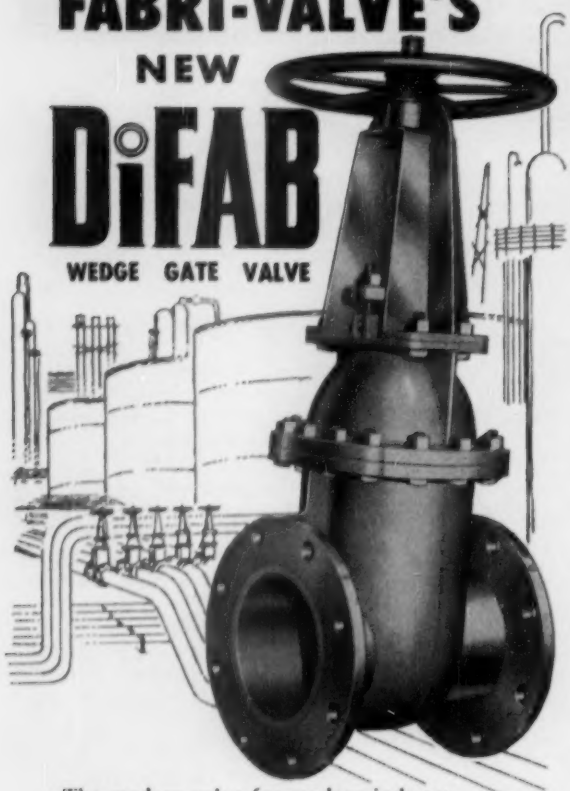
A.S.T.M.:	°F.
I.b.p. (max.)	115-145
10 per cent (max.)	140-165
50 per cent (max.)	200-235
90 per cent (max.)	260-300
End point (max.)	320-380
Loss (max.), per cent	1
Smoke point	Over 60
R.v.p.	5-9
A.P.I. gravity	64-70
Doctor test	Sweet
Corrosion	Negative
Gum (copper dish), max.	2 mg.

The lower limits of boiling range and the high vapor pressure are for Arctic climates (—40° to +37° F.) or for outdoor service (—10° to +50° F.) whereas the higher temperature limits are useful in desert climates or for general indoor service.

Although a short-boiling-range material such as a pure hydrocarbon has some advantages, yet it should not be entirely deficient in high-boiling material. The high-boiling material is somewhat useful as an absorbent for lighter, easily vaporizable material, and thus the high-boiling material tends to stabilize the vapor pressure of the fluid during a relatively long period.

Although smoke point is one of the most important properties, little information is available about the smoke point of such materials.

FABRI-VALVE'S NEW DiFAB WEDGE GATE VALVE



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ANTHRAFILT can be used in any filter requiring a filter media. Get the benefit of higher rates, longer runs and lower backwash requirements, along with a better quality of filter effluent.

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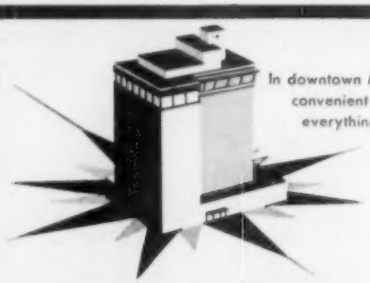

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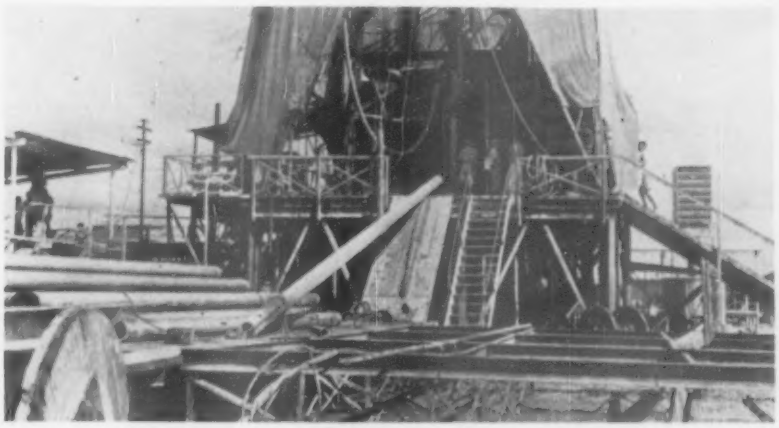
Among the Drilling Contractors



Laying down 50-ft. by 12-in. (o.d.) drill collars (world's largest) used by Assam Oil Co., Ltd., in Nahorkatiya field, India. (National Supply Co. photo.)

World's Largest Drill Collars Used in Deep India Field

Assam Oil Co., Ltd., is solving the crooked hole problem in its drilling operations in Nahorkatiya field, in Upper Assam, India, by use of specially ordered, extra-large drill collars in the drill string.

Drill collars up to 50 ft. long with outside diameters up to 12 in., each weighing 18,000 lb., are being used. They are believed to be the largest ever used anywhere in the world. Also on hand are 10-in. (o.d.) collars in both 50-ft. and 40-ft. lengths. They were made in the Torrance, Calif., plant of National Supply Co.

Use of the extra-large collars provides greater concentration of weight on the bit with reduction in the number of collars required when drilling the field's steeply dipping hard formations.

Drilling in the field is to depths of about 10,500 ft. with 29½-in. hole and 24½-in. casing to 100 ft., 20-in. hole with 16-in. casing to 1,000 ft., 14¾-in. hole with 10¾-in. casing to 7,000 ft., and 9½-in. hole with 7-in. casing to bottom.

The 50-ft. by 12-in. (o.d.) collars are used in driling the 14¾-in. hole to 7,000 ft.

The field, discovered last year, is near the starting point of the Burma Road, about 20 miles southwest of the old Digboi field.

Clark Drilling Co., Billings, Mont., is drilling as a contractor on a 6,800-ft. Frontier test at a wildcat location 3 miles northwest of LaBarge, in Sublette County, in western Wyoming. Operator is General Petroleum Co. The test is at 87-19 Unit, in 19-27n-113w.

Jennings Drilling Co., Wichita Falls, has a new wildcat operation scheduled for Morris R. Antweild in Lea County, New Mexico. Location is west of the Monument area in 30-20-36 at 1 Union-State. It is a 4,000-ft. test.

Rogers Oil Co., Scottsbluff, Neb., is drilling for E. A. Obering at a wildcat location 3 miles south of Travis and 10 miles northeast of Kimball, in Kimball County, southwestern Nebraska. The test is listed as 1 Johnson, with location in 35-16n-54w.

New Drilling Co., Denver, is associated with Ryan Oil Co. and Davis Oil Co., in a rank wildcat operation being undertaken 17 miles southwest of Scottsbluff, in Scotts Bluff County, northwestern Nebraska. Plans call for drilling to 7,000 ft. for a look at the Lakota. Location, 1 Carpenter, is in 1-21n-58w. New's tools will do the drilling.

Pennant Drilling, Ltd., Calgary, Alta., Canadian subsidiary of Signal Drilling Co., Tulsa, is under contract to Phillips Petroleum Co. for a rank wildcat

CUT *shop expense*

Cut shop expense on your drill collars by using 'Bestolife Lead Seal. Because of its high percentage of powdered metallic lead, 'Bestolife is heavy enough to stay on threads and shoulders instead of being squeezed out. This gives you extra tight leak-free joints, which are easy to break out. That's why 'Bestolife is first choice with tool pushers all over the world. See your local supply store for 'Bestolife. In 1¼, 5, 20 and 50 lb. cans. Unconditionally guaranteed.

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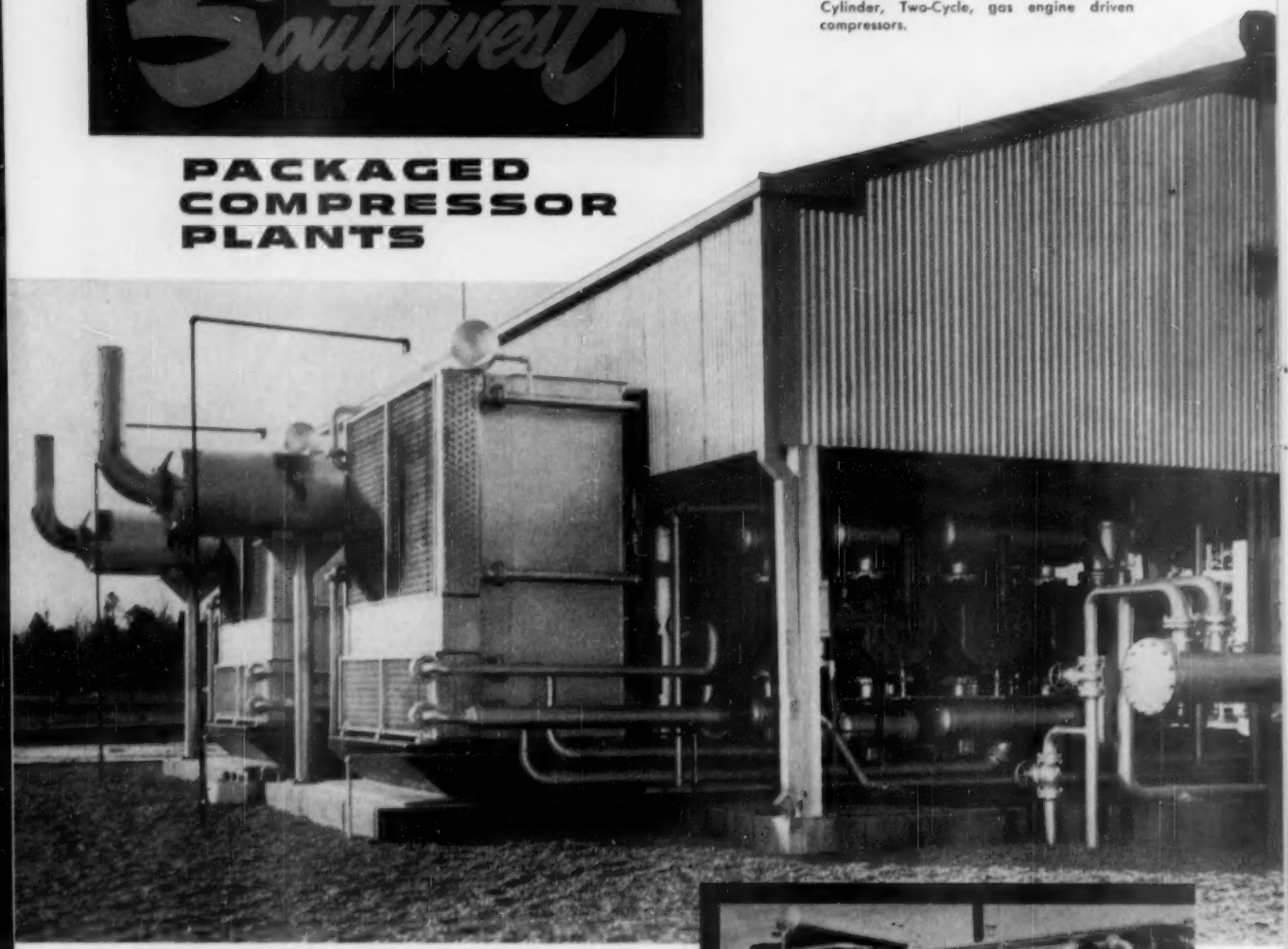
PACKAGED COMPRESSOR PLANTS

M. L. Mayfield Company's Packaged Compressor Plant, Pine Prairie Field, Easton, Louisiana. Equipped with two Southwest—Cooper-Bessemer 440 H.P. GMX 8-TF Eight-Cylinder, Two-Cycle, gas engine driven compressors.



FLARE GAS FOR GAS LIFT

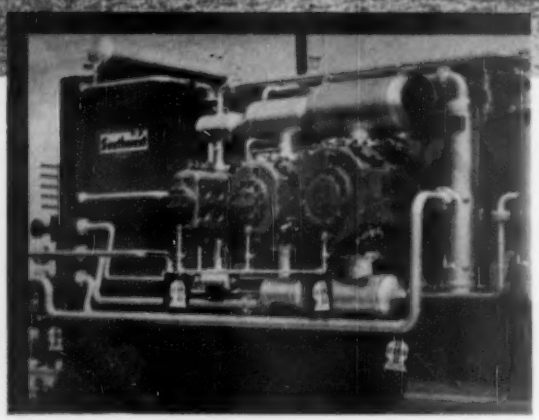
Gas pressure from wells was too erratic and too low for gas lift. But, after the installation of two 440 H.P. Southwest Packaged Compressor plants, this field gas was put to work at gas lift, and there was a surplus to sell.

These Southwest units have three stages of compression, raising the field gas from 30 to 750 psig for gas lift or to 1,000 psig to feed into a sales line.

Instead of one large unit, these two were installed to assure continuous field operation. Each unit is equipped with variable unloading equipment. Any condition that will be encountered in their operation, from one unit handling gas lift to both units operating for gas lift and sales gas, can be handled easily.

Automatic controls allow the units to run unattended except for routine servicing as a part time job of one man.

Southwest Packaged Compressor plants have lower installation cost than a conventional plant plus almost complete salvagibility if the plant should be relocated.



SOUTHWEST INDUSTRIES, INC.

Post Office Box 7773, Houston 7, Texas

test in the Sundance area, 50 miles northeast of Edson, in northwestern Alberta. The operation, at 1 Mahaska, in LSD 6, 32-57-12w5, scheduled as a Mississippian test, but may be carried to the Devonian.

Brinkerhoff Drilling Co., Ltd., Calgary, Alta., has contracted for an 8,000-ft. wildcat test to be drilled for Texaco Exploration Co. on the southeastern end of the Pembina trend of development. The test is Texaco's A-2-4, in LSD 2, 4-40-4w5. It is 15 miles southeast of the Alhambra area, producing oil from the Cardium, 12 miles southwest of Gilby area, productive of oil from Viking sand and gas from the Mississippian; and 9 miles northwest of the Medlin area, where oil is produced from Devonian and Rundle horizons, and gas from the Mississippian.

Parker Drilling Co. of Canada, Ltd., Calgary, Alta., will drill Amerada Petroleum Corp.'s projected deep wildcat test 33 miles northeast of Grande Prairie, in northwestern Alberta. The test on a Crown reservation in 9, 10-74-1w6, is scheduled to be carried to the pre-Cambrian around 10,000 ft. Location is 65 miles southwest of Peace River. It is 23 miles northwest of Sturgeon Lake field.

Power Rig Drilling Co., Lafayette, La., has moved a rig to a location ¾ mile southwest of the new Fayette Spur field, 15 miles northeast of DeQuincy, in southern Beauregard Parish, southwestern Louisiana, where it will drill for Magnolia Petroleum Co. Location is at 2-G Long Bell, in 7-6s-8w. Permit calls for a 9,500-ft. test.

Long Brothers Drilling Co. has a rig working for McCabe & Turner, of San Antonio, on a 4,000-ft. wildcat operation, 18 miles south of Mirando City, Zapata County, in Texas' Rio Grande area. Location, at 2 Lopez estate, is in the John H. Gibson Survey, Block 109. It is 238 ft. southwest of the operator's first test, drilled with the same rig, and now testing perforations at 3,680-92 ft., in Crockett sand.

Nicklos Drilling Co., Houston, will drill Continental Oil Co.'s newly announced 14,000-ft. wildcat test in Block 45, West Delta area, Gulf of Mexico, off the coast of Plaquemines Parish, Louisiana. Location is 10 miles from land, and about 3 miles south of West Delta Block 30 field. Nicklos also has scheduled another 14,000-ft. well for Continental in Rayne field, Acadia Parish, a land operation. It will be at 1 Marie Petitjean, on the south flank of the field.

Pipeline Patrol

. . . Report on Construction

Under Way, Contracted, and Planned

PIPELINE activity as reported below by The Oil and Gas Journal is compiled from information received from pipeline companies and contracting firms.

These projects include those planned, proposed, under way, and contracted. Uncontracted projects are indicated by • preceding the job.

Crude-Oil Pipelines

• **Big Horn Pipe Line Co.**—Firm has asked Wyoming Public Service Commission for permission to build a 150-mile, 8-in. crude-oil line from Ash Creek field, Wyoming, to a connection with Service Pipe Line Co.'s line at Midwest, Wyo.

Butte Pipe Line Co.—This jointly owned company of Shell Oil Co., Murphy Corp., and Northern Pacific Railroad has let contracts for its $18,000,000 crude-oil line from southeastern Montana to Guernsey, Wyo. Contractors and their spreads are:

Anderson Brothers Corp., Houston, 82 miles of 10-in. and 6½ miles of 12-in. from Glendive to Poplar, Mont.

Associated Pipe Line Contractors, Houston, sections 1 and 2, totalling 227 miles of 16-in. from the Montana-Wyoming state line to Guernsey.

O. R. Burden Construction Corp., Tulsa, 88 miles of 16-in. from Alzada, Mont., to Cabin Creek field near Baker. Company also has 15 miles of 12-in. in this area.

• **Malco Pipeline, Inc.**—Company is planning a 40-mile, 4-in. line from South Blanco Tocito field in Rio Arriba County, New Mexico, to Bloomfield, San Juan County, New Mexico. Completion set for 1955.

• **Pasotex Pipe Line Co.**—Company will substitute 20-in. pipe on 70 miles of its two 8-in. lines from Wink to El Paso, Tex. The project will increase crude-oil deliveries to El Paso by 10,000 bbl. daily. After this job is finished, Pasotex could convert the remaining sections to 20-in. line to make 200,000 bbl daily available at El Paso. In an emergency, Pasotex could give enough crude to Southern Pacific Pipe Line Co. at El Paso to supply the West Coast until another crude line could be built.

Powder River Basin Pipe Line Co.—Company will build and operate a 78-mile, 6-in. crude line from Sumatra field of central Montana to the Billings-Laurel refining area. The project will cost about $1,000,000 and will be finished by fall. Art Hartwig, Inc., is the contractor.

• **Staumount Pipeline Co.**—Company is seeking permission to build a crude-oil line from fields in North Dakota to Cromer, Man., where it would hook up with the Interprovincial line. The line would cost $6,000,000. Size not known.

• **Union Oil Co. of California.**—Company proposes to build an 815-mile line from Rifle, Colo., to Los Angeles to carry the products from its proposed Rifle, Colo., shale-oil plant to the Los Angeles refining area. The line would cost approximately $56,000,000.

• **U. S. Defense Department.**—Defense officials are considering a 97-mile, $8,000,000 line from the Elk Hills Naval Reserve in California to the Los Angeles refining area.

• **West Coast Pipeline Co.**—The off-again-on-again plans for this crude line from near Wink in West Texas to near Norwalk in California are presently before the Office of Defense Mobilization. A three-man board of nonindustry members recently recommended that the project be dropped. They questioned the ability of West Texas to produce enough crude to supply both the East and West Coasts in time of war. The three-man board favored building a line from California's Elk Hills Naval Reserve to be held in standby for possible future need.

Products Pipelines

• **American Pipe Line Co.**—Has received ODM approval to amortize 40 per cent of $178,000,000 with a rapid writeoff on proposed line to run from Gulf Coast area to New York City area. Bids for pipe requested.

• **H. W. Bass & Sons, Inc.**—Company is planning on a 152-mile, 4-6-in. L.P.G. line from Goliad Corp.'s plant in Live Oak County, Texas, to Corpus Christi.

Buckeye Pipe Line Co.—Company is converting a crude line between Toledo and Cleveland to products service. Completion is set for October 1. Company is also laying 60 miles of 8-in. products line between Lima, Ohio, and Fort Wayne, Ind. Line will be completed by the end of the year. Firm also laying 14-mile, 10-in. crude carrier between Wayne, Mich., and Detroit.

• **California - Oregon Pipe Line System.**—103 miles 6-in., proposed, Crescent City, Calif., to Medford, Ore.

Great Lakes Pipe Line Co.—Company will let contract soon for 106 miles of 12-in. line between Des Moines and Iowa City, Iowa. The line will be finished by fall and will parallel existing 6 and 8-in. lines.

Keystone Pipe Line Co.—Sheehan Pipe Line Construction Co. is laying 49 miles of 8-in. for the company between Westchester and Allentown, Pa.

Sinclair Pipe Line Co.—Gray-Morrison Contractors, Inc., is laying 31 miles of 12-in. for the company between Dayton and Sour Lake, Tex. Completion set for August 15.

Southern Pacific Pipe Lines, Inc.—Company has completed letting most of the contracts for its 846-mile products line from Los Angeles into Phoenix and El Paso into Phoenix. The contractors are:

. . . Schedule 1—158 miles of 8-in. between El Paso and Lordsburg, N. M., under construction by Morrison-Knudsen Co., Los Angeles, and River Construction Co., Fort Worth.

. . . Schedule 2—145 miles of 8-in. between Lordsburg and Tucson under construction by R. H. Fulton & Co., Lubbock, Tex.

. . . Schedule 3—122 miles of 8-in. and 35 miles of 12-in. from Tucson to Hassayampa, Ariz., contracted by Hood Construction Co., Lynwood, Calif.

. . . Schedule 4—128 miles of 12-in. from Hassayampa to Yuma, Ariz., let to Macco Corp. and Alex Roberson Co., Paramount, Calif.

. . . Schedules 5 and 6—197 miles of 12-in. between Yuma and Colton, Calif., let to Conyes Construction Co., San Pablo, Calif.

. . . Schedules 7 and 8—61 miles of 16-in. between Colton and the Watson, Calif., refining area not awarded yet.

• **International Pipe Line, Inc.**—132 miles, 8-in., proposed, Wrenshall to Minneapolis, Minn. Cost: $4,200,000.

Moore Stoner Co.—Company has $2,500,000 tax amortization for a 200-mile, 6-in. products line from a connection with Oil Basin Pipe Line Co.'s terminal at Glendive, Mont., to Minot, N. D.

Okan Pipe Line Co.—This subsidiary of Warren Petroleum Corp. has awarded work to two contractors for its L.P.G. line from western Oklahoma and Kansas to Tulsa. Vaughn & Taylor Construction Co. has 260 miles of 3 to 6-in. gathering lines, and R. H. Fulton has 140 miles of 6-in. transmission line from western Oklahoma into Tulsa.

Sioux Oil Co.—Company will build a 55-mile products, 8-in. line from its Newcastle, Wyo., refinery to Rapid City, S. D.

• **Sunflower Pipe Line System.**—Company proposes to build a 215-mile, 6-in. line to transport L.P.G. from six counties in western Kansas to Wichita. Application approved by Kansas Corporation Commission.

Texas Eastern Transmission Corp.—Company has received Federal Power Commission approval to abandon the "Little Inch" gas line and to convert it to products service. The company will spend $13,000,000 converting the line back to products. When finished the line will have a capacity of 235,000 bbl. daily.

Non-Petroleum Pipelines

American Gilsonite Co.—Company has announced plans for a 100-mile pipeline from near Bonanza, Utah, to a proposed gilsonite refinery in western Colorado. The company, owned by Barber Oil Corp. and Standard Oil Co. of California, plans to make gasoline and coke by refining gilsonite. The gilsonite would be moved in a slurry.

Pittsburgh Consolidation Coal Co.—This firm has announced plans for the first pipeline to move coal. The line will be 108 miles of 10-in. from the company's Georgetown mines in eastern Ohio to Cleveland Electric Illuminating Co.'s Eastlake power plant northeast of Cleveland. Construction will start this fall as soon as right-of-way can be procured. Ford, Bacon & Davis, Inc., will issue specifications, let contracts, and supervise the construction work.

Natural-Gas Pipelines

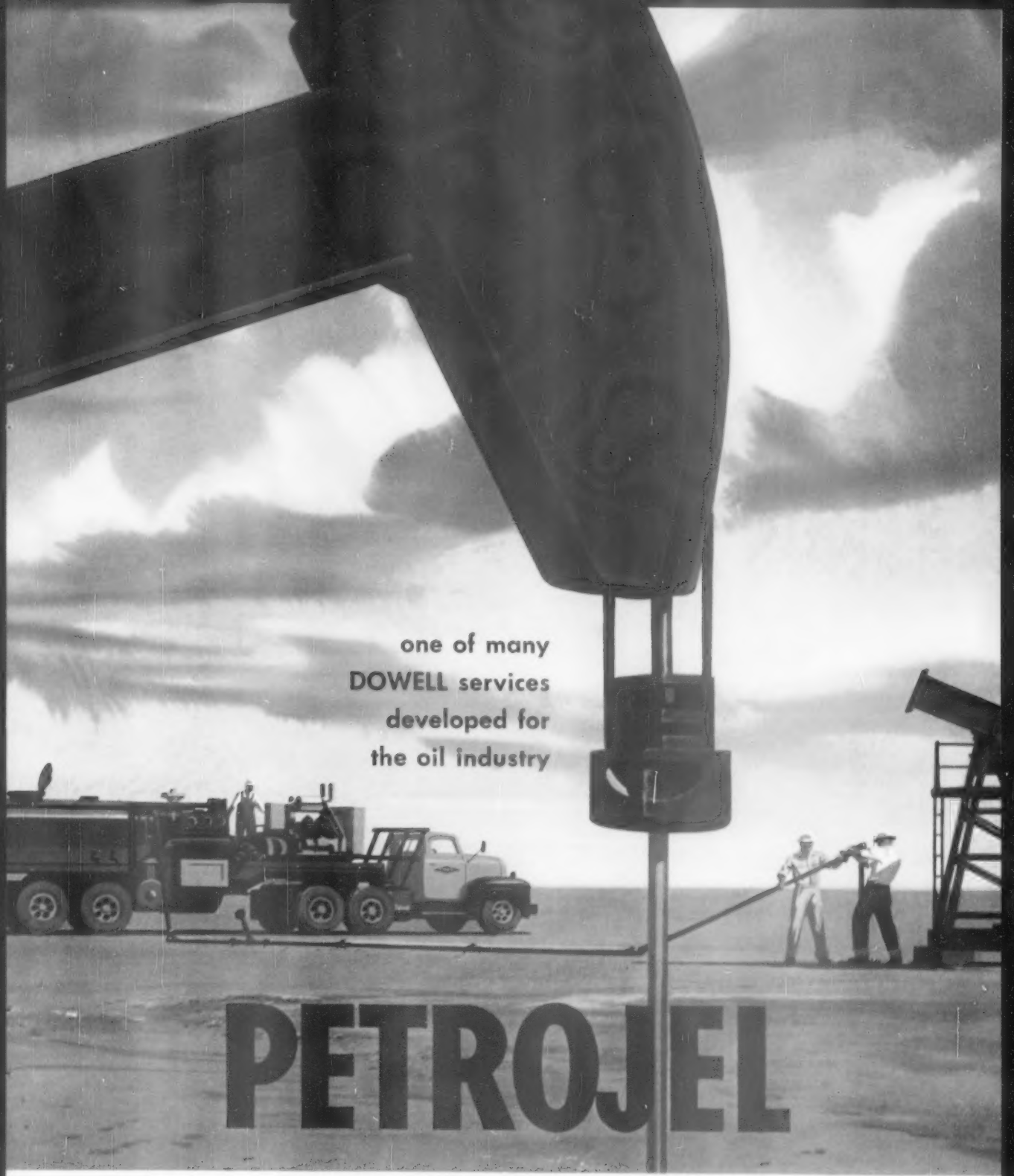
• **Alabama-Tennessee Natural Gas Co.**—Company has proposal before FPC to lay 21 miles of 12-in. line west from its present line in Colbert County, Alabama.

American Louisiana Pipe Line Co.—Company has let the bulk of its 1,121 miles of natural-gas line from North Tepetate, La., to Detroit. H. C. Price Co., Bartlesville, Okla., and Houston Contracting Co., Houston, were awarded 783 miles of 30-in. Brown & Root, Inc., Houston, was awarded approximately 221 miles of 30-in. from North Tepetate to the Arkansas-Louisiana border. The only section not awarded is a 22-in. spur from Payne, Ind., to Bridgman, Mich. Price will have two spreads in the field. One will work south from the Hancock-Henry county line in Indiana, the other will work north from Slaughters, Ky. Houston Contracting will also work two spreads. One will start working south from Detroit and the other north from the Hancock-Henry county line.

Atlantic Seaboard Corp.—Company has let 82 miles of 26-in. gas line in Virginia, West Virginia, and Maryland. Pipe Line Construction & Drilling Co., Lemoyne, Pa., has 32 miles in three sections. Williams-Austin Co., Pittsburgh, has 40 miles in West Virginia. Job set for completion the last of August.

• **Carolina Natural Gas Corp.**—185 miles 2-12-in., proposed lateral lines off Transcontinental in North and South Carolina.

• **Central Hudson Gas & Electric Corp.**—Company has filed application with FPC to



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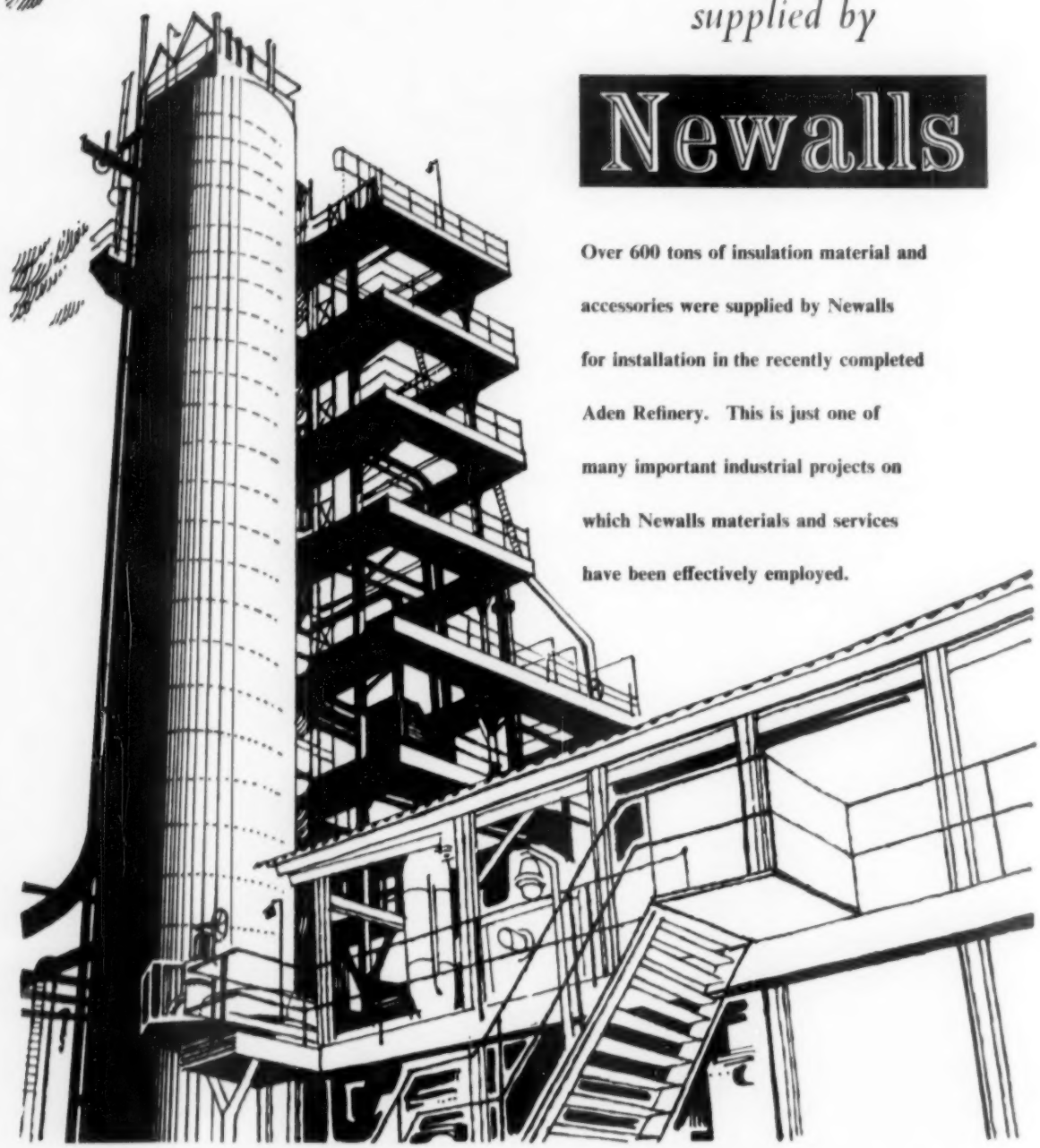

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Pipeline Patrol

construct 48 miles of 12-in. line from Albany to Kingston, N. Y. Line will be started and completed in 1955 if FPC approves.

• **Cities of Clarendon and Marvell, Ark.**—Cities have filed for FPC permission to interconnect their facilities with Texas Gas Corp.'s line south of Helena, Ark. The cities will build 53 miles of 4, 5, and 6-in. line to transport the gas.

• **Cities Service Gas Co.**—Company has Federal Power Commission permission to build a 93-mile, 26-in. natural-gas line from Blackwell, Okla., to Independence, Kans. The company also proposes to build a 145-mile gathering system in Woods County, Oklahoma, and Barber County, Kansas. The two jobs will cost $8,422,400.

• Company has FPC authority to remove 41 miles of line and to construct 39 miles as replacement in Newton, Lawrence, Lafayette, and Johnson counties, Missouri, and Johnson County, Kansas. The projects will cost $1,685,000.

• **Coastal Transmission Co.**—Company plans to build 550 miles of 30-in. line from near McAllen in South Texas to near Baton Rouge (See Houston, Texas Gas & Oil Co.)

Colorado Interstate Gas Co.—Company has let first part of its 380-mile, 22-in. line from Rock Springs, Wyo., to Denver to Houston Contracting Co. The construction firm is working on 126 miles from near Laramie, Wyo., to Denver. The line will pick up its gas from Pacific Northwest at Rock Springs.

Colorado Interstate Gas Co.—Company is also spending $4,200,000 extending its gathering lines in the Panhandle of Texas, Oklahoma, and Kansas. Work will be done this summer.

• **Colorado-Wyoming Gas Co.**—Company has application before FPC to build approximately 20 miles of 4 to 16-in. line in the suburbs of Denver. The facilities will cost about $581,000.

East Ohio Gas Co.—Company has let contract to Williams Brothers Co. to lay 112 miles of 30-in. from Miumee, Ohio, to Cleveland. Completion is set for October 1.

• **El Paso Natural Gas Co.**—Company has three plans ready to present to the FPC to increase its California capacity. The preferred plan calls for the company to loop its 500-mile, 30-in. line from the San Juan basin to the California border with a 34-in line. If this fails to win approval, the firm will offer to build a 30-in. line from Pacific Northwest's line at Mountain Home, Idaho, to the San Francisco area. Another plan is to build a 30-in. line from near Pendleton, Ore., into California. Company feels the looping program will be required even if one of the alternate plans would win approval.

Gas Service Co.—Company is spending $216,000 building a 14-mile, 12-in. gas line from Kansas City to the new Mid-Continent International Airport there.

• **Houston, Texas Gas & Oil Co.**—Company plans to build 600 miles of 30-in., and 350 miles of 18-24-in. line to carry natural gas from Baton Rouge to Miami. Line will join with Coastal Transmission's proposed line from McAllen, Tex.

Kansas-Nebraska Natural Gas Co., Inc.—Company is presently laying 53 miles of 4, 6, 8, and 10-in. gathering lines in the Hugoton, Guymon, Unruh and fields in Kansas and Oklahoma, and in the Denver-Julesburg basin in Colorado. Sterling Construction Co., Sterling, Colo., Brodie Contsruction Co., Amarillo, Tex., Cheek Construction Co., Ulysses, Kans., and L. F. Nichols Construction Co., Great Bend, Kans., are doing the work. Nichols also is laying 9 miles of 2-in. between Cairo and Henderson, Nebr. Sterling also has 14 miles of 2, 3, and 4-in. around Otis and Yuma, Colo. Brodie Construction also has contract for 37 miles of 4 and 6-in. gathering lines in the Denver-Julesburg basin. Kansas-Nebraska also is taking bids on 10 miles of 12-in. transmission around Webster, Kans. Thirty-seven miles of 3 and 4-in. transmission line around Tribune, Kans., and Kimball, Nebr., is awaiting approval.

• **Kentucky West Virginia Gas Co.**—Firm has FPC permission to construct 32 miles of line to connect with a line to be built by Clinchfield Coal Corp. near Osborne Gap, Ky. The line will extend to Kentucky West Virginia's existing system near Maytown, Ky. The Clinchfield job will cost $785,000. The Kentucky West Virginia work will cost $1,455,000.

• **Lone Star Gas Co.**—Company has two plans up before FPC to enlarge its system in Texas and Oklahoma. One is for an $18,000,000, 230-mile line from Cotton County, Oklahoma, to Fritch, Tex. The other plan is for a 205-mile line from Snyder, Tex., to a hookup with the Cotton-Fritch line. The company hopes to prevent Natural Gas Pipeline Co. of America from building its line from Wise County, Texas, to Fritch (see below).

• **Michigan Consolidated Gas Co.**—25 miles, 12-in., proposed, from near Sparta to Muskegon, Mich.

Michigan Gas Storage Co.—Bechtel Corp. has contract to build 36 miles of 16-in. line from Mount Pleasant Junction to Milwaukee, Mich. The line will cost $2,500,000. Bechtel has set October 15 as completion date.

• **Michigan Wisconsin Pipe Line Co.**—251 miles, proposed, 24, 18, 12, 6, and 4-in. loops. Majority will be in Wisconsin.

• **Montana-Dakota Utilities Co.**—Company has FPC authority to construct 44 miles of pipeline and 1,090 hp. in compressor capacity on its system in South Dakota and Wyoming. Estimated cost would be $1,414,218.

• **Natural Gas Storage Co. of Illinois**—Company has asked FPC authority to build 31 miles of 36-in. line from its storage field in Kankakee and Iroquois counties, Illinois, to a connection with Texas Illinois Natural Gas Pipeline Co.'s line where it crosses the Illinois River.

• **Natural Gas Pipeline Co. of America.**—Company now before FPC on plans to build 350 miles of 20 and 26-in. line from Wise County, East Texas, to its station 111 at Fritch, Tex.

Nevada Natural Gas Co.—Company plans looping program along its 114-mile line from Needles, Calif., to Las Vegas, Nev. Mileage and size are unknown but cost will be about $2,500,000.

• **New River Gas Co.**—50 miles, planned. Summers to Monroe counties, West Virginia, to Narrows and Dublin, Va.

• **New York State Natural Gas Corp.**—Company has FPC permission to lay 21 miles of 20-in. line from Genesee Falls, Wyoming County, New York, to York, Livingston County, New York. FPC permission was received the last of June. Work should start in July and wind up in August.

• **Niagara Mohawk Power Corp.**—Company plans no major transmission lines for 1955. However, itp lans to add more than 300 miles of distribution mains.

• **Northern Natural Gas Co.**—Company has cancelled its 1955 construction program listed below until 1956 due to Trans-Canada Pipe Lines, Ltd., being delayed in starting its line. The program, which is now set for 1956, included:

• Canadian Extension—188 miles of 24-in. from Canadian border to near Wahpeton, N. D. 215 miles of 30-in. from Wahpeton to Farmington, Minn.

• South Dakota Extension—94 miles of 12-in. from Sioux Falls to Watertown-Huron. 71 miles of 10-in. from Watertown-Huron to Duluth-Superior.

• Duluth-Superior Extension—167 miles of 24-in. from Farmington to Duluth-Superior.

• Company has also asked FPC permission to build and operate $4,800,000 worth of pipeline facilities for use in testing an underground natural-gas storage field near Redfield, Iowa. The project would involve construction of 29 miles of 30-in. pipe.

• **Ohio Fuel Gas Co.**—Firm has applied for FPC permission to build 19 miles of 16-in. line in Hardin and Allen counties, Ohio, partially looping an existing line.

Pacific Gas & Electric Co.—Company is working on 18 miles of 12-in. from Beehive Bend field to W/O Gridley in California. The job is slated for completion in September.

• Company plans 21 miles of 16-in. line from Marysville to Lincoln, Calif. Job will start in June and wind up in September.

• Company's long-range plans call for looping the Topock-Milpitas line with 135 miles of 34-in. The major part of the line will be laid in 1956, while 62 miles will be laid in 1957.

Pacific Northwest Pipe Line Corp.—Firm has let the initial contracts of its 1,466 miles gas line from the San Juan basin to Bellingham, Wash. The first contracts total $11,236,000. Contractors and their sections are:

River Construction Co., two sections totalling 150 miles of 26-in. between Ignacio, Colo., and Moab, Utah.

R. H. Fulton Co., two sections totalling 160 miles of 26-in. between Moab and Jensen, Utah.

Associated Pipeline Contractors, Inc., one section of 77.6 miles of 26-in. between Jensen and Green River, Wyo.

A. J. Curtis Construction Co., one section of 82.8 miles of 22-in. from Green River to Sage, Wyo.

B & M Construction Corp., one section of 90 miles of 22-in. between Sage and Lava Hot Springs, Idaho.

Midwestern Constructors, Inc., one section of 95 miles of 22-in. from Lava Hot Springs to Burley, Idaho.

H. B. Zachry Co., San Antonio, sections 9 and 10, 214 miles of 22-in. between Burley and Payette, Idaho.

Fulghum Construction Co., Harrisburg, Pa., sections 11 and 12, 198 miles of 22-in. between Payette and the Columbia River at the Oregon-Washington border.

A. J. Curtis Construction Co., Casper, section 26, 54 miles of 16-In. laterals and 31 miles of gathering-system lines from a point on the main line near Kemmerer, Wyo., to Big Piney field, Wyoming.

R. H. Fulton, Lubbock, section 27, 43 miles of lateral lines and 16 miles of gathering lines from Rangely, Colo., to Piceance Creek field, Colorado.

• **Panhandle Eastern Pipe Line Co.**—Company has plans to loop Peoria lateral before FPC now. The line would be 16-in. pipe running 58 miles from near Springfield to Peoria, Ill.

• **Pine Tree Natural Gas Co.**—204 miles of undetermined size pipe to run from the Boston area to Bangor, Me.

Private Interests.—Proposes to build gas line from Gubik gas field near Navy Petroleum Reserve No. 4 in Alaska to Fairbanks. Line would be 450-mile, 8-in. line and Arctic Contractor, Inc., who handled engineering requirements and preliminary design, estimated the line would cost $20,000,000, although later figures have been much higher than this.

Tennessee Gas Transmission Corp.—Company is carrying out a large expansion program in New York, Pennsylvania, New Jersey, and Ohio. Oklahoma Pipe Line Constructors is working on 113 miles of 24-in. line from Covington to Laska-Waxen, Pa. Bechtel Corp. has lines for the company in New Jersey, and Pennsylvania. H. C. Price Co. has 130 miles of 24 and 26-in. in Ohio and Pennsylvania.

The company has FPC approval for 370 miles of 30-in. from Agua Dulce, Tex., to Kinder, La. The line will cost $35,400,000.

Pipeline Patrol

The firm has also requested FPC permission to spend $56,000,000 in new pipeline and compressor facilities. The work will include 221 miles of 26 and 30-in. loops in Ohio and Kentucky and 376 miles of gathering lines in Louisiana and Texas. Some 12,450 hp. would be added in new and existing compressor stations in Texas, Louisiana, and Mississippi.

Texas Eastern Transmission Co.—Company has received FPC permission to begin converting its Little Inch line from natural gas to products service. Company has also proposed to Mobilization Director Arthur S. Flemming that the Government give it accelerated amortization on money to invest to put the Big Inch line on standby product service. The company's program is:

...To convert the Little Inch to products with a capacity of 235,000 bbl. daily and to install enough standby pumping equipment to hike the capacity to 375,000 bbl. daily if needed.

...To install standby pumping equipment along the Big Inch that would allow the line to be converted from gas to products in an emergency. The line would have a capacity of 425,000 bbl. daily.

...To build a 382-mile, 30-in. natural-gas line from Beaumont to Kosciusko, Miss., to connect with an existing 30-in. line running to Connelsville, Pa.

Contracts for this line have been let as follows:

Houston Contracting Co., Houston, 59 miles from near Beaumont to 12 miles east of DeQuincy, La.

Tulsa Williams Co., Tulsa, 118 miles from 12 miles east of DeQuincy to a point on the west side of the Mississippi River near New Roads, La.

H. C. Price Co., Bartlesville, Okla., 134 miles from near New Roads to 2 miles southeast of Clinton, Miss.

H. B. Zachry Co., San Antonio, 64 miles from Clinton to near Kosciusko, Miss.

The Texas Eastern proposal clashes with a plan of American Pipe Line Co. to build a line from the Gulf Coast to New Jersey (See table under products).

Texas Gas Transmission Corp.—Company has big building program set to start soon and end approximately November 1.

From Covington, Ky., to Jefferstown, Ky., company will build 77 miles of 26-in. H. C. Price Co.

Company will loop 14 miles of 20-in. at Haughton, La. Houston Contracting Co.

Will build 72 miles of 12-in. from Hardinsburg, Ky., to Bedford, Ind. Also will build 5 miles of 8-in. near Bedfoard. H. C. Price.

From Bastrop, La. to Clarksdale, Miss., the company will lay 50 miles of 30-in. H. C. Price.

From Eunice, La., to Morgan City, La., the firm will lay 105 miles of 20-in. H. C. Price.

• Company has also filed with the FPC for permission to add 198 miles of line and an additional 20,270 hp. in compressor capacity along the route of its system in Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, and Indiana. The project will cost $20,000,000.

Transcontinental Gas Pipe Line Corp.—Company has awarded the following contracts to lay 315 miles of 36-in. and 219 miles of 30-in.

Associated Pipe Line Contractors, Inc., will lay 63 miles of 36-in. in Louisiana and Mississippi and 71 miles of 30-in. in Virginia and Maryland.

Midwestern Constructors, Inc., will lay 14 miles of 30-in and 54 miles of 36-in. in Alabama and Georgia.

Western Constructors will lay 77 miles of 36-in. in Georgia and South Carolina.

Panama-Williams Co. will lay 36 miles of 30-in. and 31 miles of 36-in. in South Carolina and North Carolina.

Williams Brothers Co. will lay 72 miles of 30-in. in Virginia.

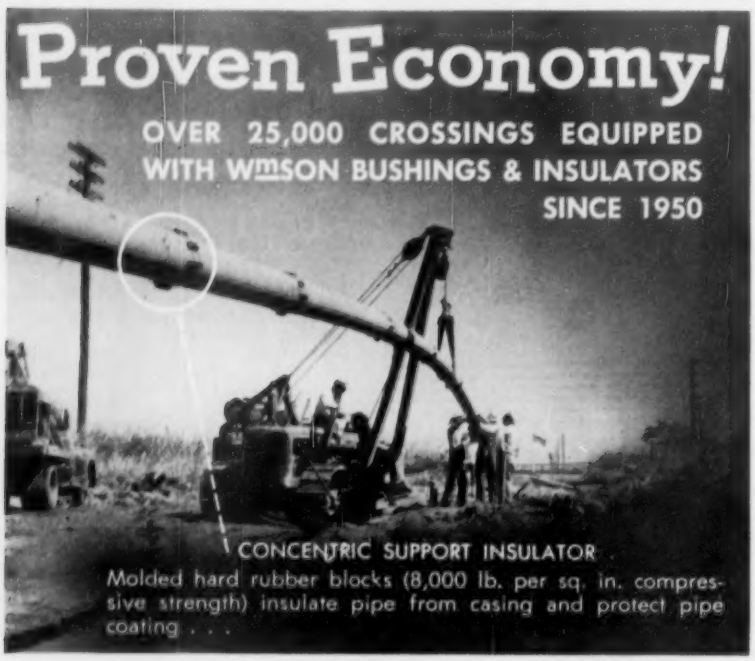
• Company has received FPC examiner approval to build 24 miles of line in South Bayou Mallet, Maxie, and Happytown fields in Louisiana to gather gas for movement in its interstate lines.

Transok Pipe Line Co.—Company has let contract to Pipe Line Service Co., Seminole, Okla., to lay a 140-mile, 24-in. line from Garvin County, Oklahoma, to Tulsa. The firm will also build a gathering system in the Bradley, West Lindsay, and Northwest Purdy fields.

• **Trunkline Gas Co.**—Firm has applied to FPC for authority to build eight new compressor stations and 24 miles of pipeline on its transmission system to enable it to sell additional gas to Panhandle Eastern Pipe Line Co. Total capacity of the new stations would be 56,000 hp. Total cost would be $18,700,000, including $1,000,000 for gathering facilities in the Gulf Coast area. Panhandle filed for 1,600 hp. additional compressor capacity to cost $3,714,000.

• **United Gas Pipe Line Co.**—Company has applied to FPC for permission to construct 63 miles of 16 and 20-in. natural-gas line in Mississippi, Alabama, and Florida. The company will also add 330 hp. to its compressor stations. Cost for the job will be about $8,300,000.

• **Utah Natural Gas Co.**—Planning 40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FOR MORE INFORMATION AT THE BOTTOM OF YOUR WELL

Double Shut-In Pressure Readings Provide More Information — In Less Time — Than Other Methods

"WHAT IS THE main advantage of double shut-in pressure readings?" That's a question often asked by those who have not yet tried this newest method of drill stem testing.

Actually there are *four* main advantages of the double shut-in pressure method:

1. Maximum formation pressure build-up in shortest time.
2. Comparison of reservoir build-up pressures before and after test.
3. Two separate chances to obtain reservoir pressure.
4. The measuring of the true equilibrium pressure prior to producing the formation provides a virgin pressure measurement and more accurate data.

Perfected by Johnston Testers, this new technique requires only a simple rearrangement of the test tool assembly. By placing a disc valve above the main or hydraulic valve, a specified volume of air is trapped between these two valves. This volume of air is called the "air chamber."

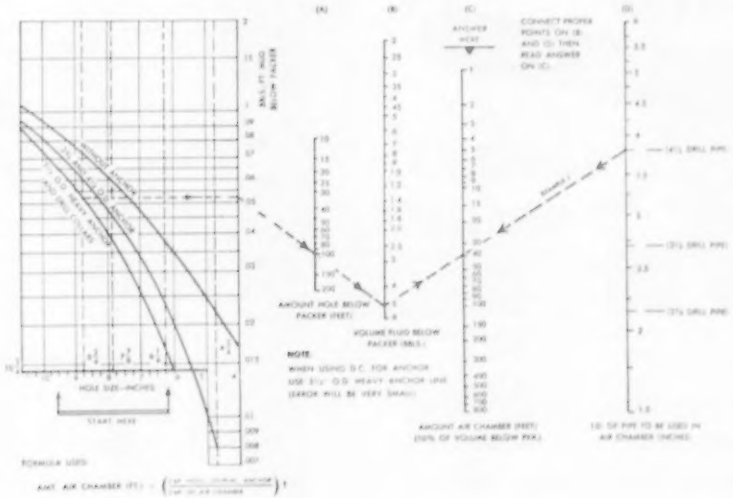
As the purpose of the air chamber is to relieve the mud pressure trapped below the packer, the secret of success of double shut-in testing is accurate use of this air chamber. Best results have been obtained when volume of the air chamber is about 10% of the volume of mud below the packer.

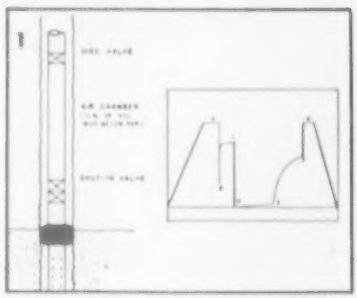
In the past, it has been common to calculate the air chamber to the nearest 30-foot pipe length. This lack of accuracy has often caused a failure to record the *maximum* initial shut-in pressure.

To overcome this problem, and to do away with complicated mathematics, Johnston has developed an "air chamber alignment chart." By simply drawing straight lines between known figures, the amount of air chamber needed can be calculated quickly and accurately.

The chart below shows how simple it actually is to use this method.

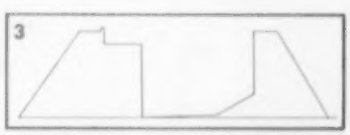
Complete information on double shut-in testing is available from Johnston Testers, Houston, Texas. Write today for complete descriptive folder.





Testing tool assembly for double shut-in pressure readings which permits a limited fluid withdrawal. By placing the disc valve above the main or hydraulic valve so that a specified volume of air is trapped between these two valves.

Well not capable of producing fluid fast enough to fill up air chamber and cause pressure build-up.



Mud did not expand enough to get pressure draw-down below the formation pressure.

Mud expanded and pressure draw-down was below the formation pressure. Well was able to flow enough fluid to fill up air chamber and build-up shut-in pressure.

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Pipeline Patrol

miles from Orem to Salt Lake City, 16-in. pipe at later date. Contract not yet let.

• **Washington Gas Light Co.**—Company seeks FPC permission to build 11 miles of 24-in. natural-gas line from its Chillum station in Maryland via its East station in the District of Columbia to Gordon's Corner, Md. The line will also cross the Anacostia River. Cost is estimated at $2,000,000.

Foreign Crude-Oil Pipelines

• **Atlas-Dresser.**—Included in this company's agreement with the Argentine Government are plans to build a 400-mile, 16-in. crude line from Plaza Huincul area to Bahio Blanca.

Bolivian Government—Williams Brothers has contract to build a 220-mile, 6-in. crude-products line from Cochabamba to Orura to La Paz. The line is described completely in The Oil and Gas Journal of May 16, 1955, page 136.

Canadian Gulf Pipe Line Co.—Williams Brothers has contract to build 17 miles of 4-in. and 36 miles of 6-in. for this company from Clive and Joffre fields to its connections at Stettler.

• **Cremona Pipe Line Co.**—Firm has announced plans for a 60-mile crude-oil line from the Westward Ho-Sundre area to Calgary.

Peace River Oil Pipe Line Co., Ltd.—Fulton-Banister, Ltd., has contract for 106-mile line from Sturgeon Lake field in Northwest Alberta to the Edson pumping station of Trans Mountain Oil Pipe Line Co., Ltd. The project includes 41 miles of 16-in. and 65 miles of 12-in. Completion is set for October 1.

Pembina Pipe Line, Ltd.—Company has let approximately 400 miles of gathering lines in Pembina field to Hupp, Ltd. Work began last year and will be completed in November 1955.

• **S & M Pipeline, Ltd., and Westspur Pipeline Co.**—Former company is a subsidiary of Canadian Devonian Petroleums, Ltd., and proposes to build a 100-mile crude line from southeastern Saskatchewan to the Interprovincial Pipeline Co. line at Cromer, Man. Westspur, a subsidiary of Imperial Oil, Ltd., proposes to build the same line. Another company, Trans Prairie Pipe Lines, Ltd., also is seeking a permit to build a similar line.

• **Standard - Vacuum Oil Co.**—Company has long-range plans for a 90-mile pipeline to give the new Lirik field in Central Sumatra an outlet. Completion is not scheduled before 1957 or 1958.

Yacimientos Petroliferos Fiscales Bolivianos—Williams Brothers has contract to build a 230-mile, 6-in. products line from Cochabamba-Oruro-La Paz. The line will cost approximately $7,000,000. The Bolivian Government will eventually add a 10-in. products line from Oruro to Arica, Chile.

Foreign Products Pipelines

• **Empresa Nacional del Petroleo.** — 80 miles, 6⅝-in., planned, Concon to Santiago, Chile.

• **Governments of South Rhodesia and Portuguese East Africa.** — 200 miles, considered. Beria, Portuguese Mozambique to Umtalia, Southern Rhodesia.

• **Iraq Petroleum Co., Ltd.**—Company is making plans to lay a 75-mile, 24-in. products line from Homs, Syria, to Tripoli, Lebanon. The line would have a capacity of 180,000 bbl. daily.

• **National Fuel Oil Co.**—This company in Israel is a shareholder in a company which plans to build a products line between Haifa and Tel Aviv. The plans call for a 55-mile 6-in. line in which the Government would own 10 per cent.

• **National Iranian Oil Co.** — Company plans $32,300,000, 573-miles, 10-in. products pipeline from Ahwaz to Teheran, Iran. The line will have a capacity of 40,000 bbl. daily. Costain-John Brown, Ltd., London, will build the 337-mile southern part. Entrepose, Paris, will build the northern 236 miles.

• **North Atlantic Treaty Organization (NATO).**—This defense organization is building products lines to airforce bases in various parts of France. Approximately 2,000 miles of 4-10-in. line will be laid.

Oleoducto del Pacifico, S.A.—Company is building 100-mile, 6 and 8-in. products line from Buena Ventura to Cali, Colombia. Pipeline Engineering Co. of Dallas, Tex.,

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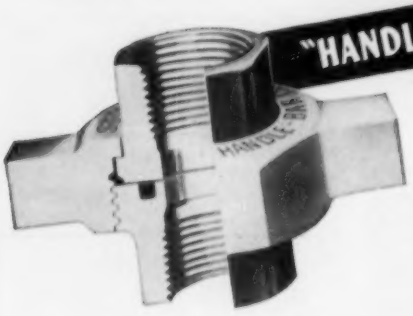

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PIPE LINE SURVEYS

Pipeline Patrol

has the engineering contract. Williams Brothers is laying the line.

Overland Pipeline Corp.—This South African firm has requested government permission to build a 350-mile line, to cost $8,450,000, from the South African coast to Rand, a plateau area in southern Transvaal where there is heavy petroleum consumption.

• **Sinclair Oil Corp.**—Company is considering a 240-mile crude-oil line from its San Silvestre field in the state of Barinas, Venezuela, to Puerto Cabello on the Caribbean Sea coast. The line would cost $25,000,000.

• **United States Government.** — 375 miles, 12-in., planned, St. Nazaire to Melun and Metz, France.

U. S. Defense Department.—U. S. Defense Department is sponsoring a 485-mile, 8, 10, 12-in. products line from Cadiz to Zaragoza, Spain. The contract has been let to Merritt, Chapman & Scott; Benson & Montin of Oklahoma City; and Agroman Construction Co., a Spanish firm. Brown-Raymond-Walsh is the prime contractor. Cost of the line will be approximately $5,000,000.

Winnipeg & Central Gas Co.—Canadian company plans to build a $20 million butane-propane system. Company plans to get gas L.P.G. from Signal Oil & Gas Co.'s Tioga, N. D., plant and move it to Winnipeg. Size and route of the line has not been definitely established.

Foreign Natural-Gas Pipelines

Alberta Gas Trunk Line, Ltd.—This Canadian firm has let engineering contracts to two firms, Dutton, Williams Brothers, Ltd., and Mannix, Ltd., for a 300-mile, big inch gas-gathering system to collect Alberta's natural gas for transportation to Trans Canada Pipe Line Co.

Attock Oil Co.—Company plans to build 60-mile natural gas pipeline from Dhulian field to Rawalpindi in West Pakistan.

• **Canadian Western Natural Gas Co.**—Firm will begin work this spring on a $1,000,000, 59-mile natural-gas project in southern Alberta. The company will also add a compressor station at Lethridge, Alta.

• **Empresa Nacional del Petroleo.** — 80 miles, 10-in., planned, Concon to Santiago, Chile.

• **North Canadian Oils, Ltd.**—Company will lay 136 miles of 10-in. line from Wabumun to Hinton, Alta. The gas will be sold to a pulp mill at Hinton. Mid-Western Industrial Gas, Ltd., which will supply the gas along with North Canadian, will build a line from its gas fields in the Alexander, Majeau Lake, and Westlock districts to Wabumun.

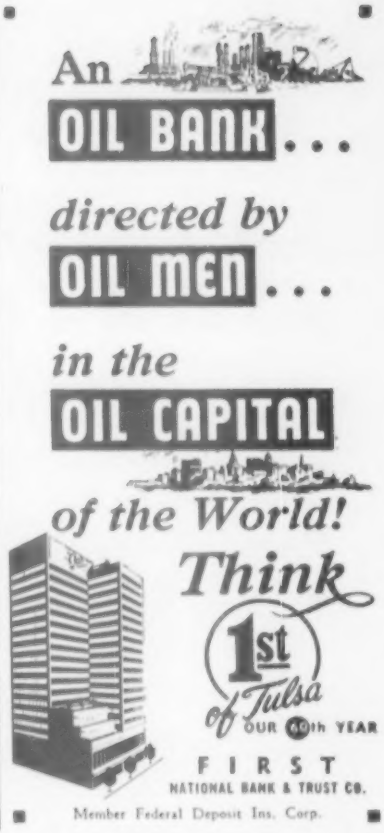
South Alberta Pipe Line, Ltd.—Company has filed permit to construct a 150-mile, 8-in. natural-gas line from Etzikom field to serve a nitrochemical plant to be built near Medicine Hat, Alta. The line will cost about $1,000,000.

Trans-Canada Pipe Lines, Ltd.—Company has postponed start of 2,250 miles of 24-34-in. line from Alberta-Saskatchewan border to Toronto and Montreal until next year because of financing difficulties. Company also plans a 24-in. lateral from Winnipeg to Emerson, Man. Twenty-inch lateral from Niagra to Toronto now in operation. Plans for line to enter U. S. may be considered.

Saskatchewan Power Corp.—Company has let contract to Majestic Contractors, Ltd., Edmonton, for a 226-mile natural-gas pipeline from Coleville to Prince Albert. The line from Coleville to Saskatoon will be 116 miles of 14-in. From Saskatoon to Prince Albert, the line will include 40 miles of 12-in. and 70 miles of 10-in. Banister Construction, Ltd., has the distribution system for Prince Albert.

• **Sui Transmission Co.**—Firm is considering a second natural-gas line in Pakistan. This line would run 400 miles from the Sui gas fields to Lahore. The cost would be about $30,000,000.

• **Westcoast Transmission Co., Ltd.**—Company has signed agreement with Pacific Northwest Pipeline Corp. and has revived plans for its line from the Peace River area of Alberta and British Columbia to the United States border near Sumas, Wash. Plans call for work to begin sometime this year. Company has also announced plans for a second line to parallel the first and to swing east into the Okanagan Valley.



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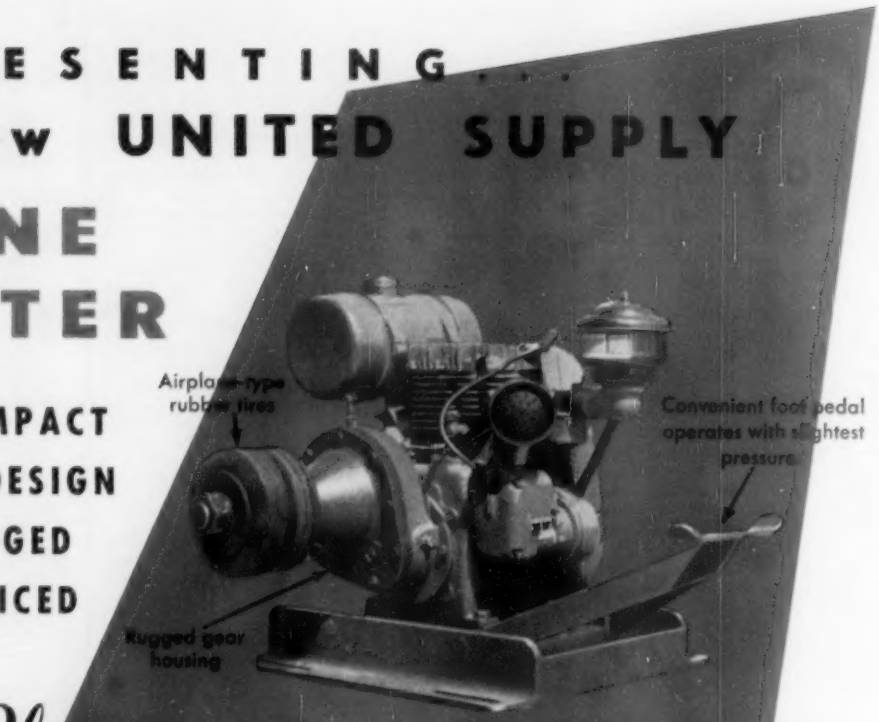

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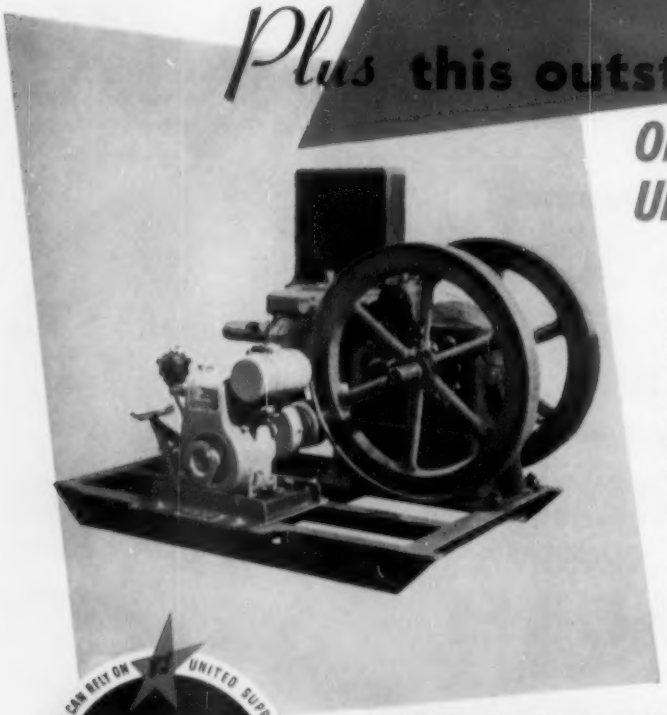

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OF NEW EQUIPMENT AND LITERATURE

by Dan B. Miller

Hayward Voltmeter Has Two Sensitivities

One of the most common measurements required in corrosion control and cathodic-protection work is structure-to-soil potential. Because of the soil resistance inherent in the measuring circuit, precise measurement of this voltage has been possible only with a voltage-measuring system which draws no current at the instant of measurement.

A new instrument, the Hayward Model 610 dual-sensitivity voltmeter, consists essentially of a special voltmeter movement having two different

sensitivities. D.c. voltage ranges of 0-0.2/1/2/10/20/100 are provided, as well as a short position to short-circuit the movement when carrying the instrument. No tubes or batteries are used or required.

The instrument is simple to use and is accurate. It is connected to the source of voltage, proper polarity selected, and a reading obtained. The push button on the panel is then depressed and a second reading obtained.

While the primary application of the Model 610 Voltmeter is measuring structure to soil potential, it could also be used to measure structure to structure potential and voltage drop in the soil itself. **For more information write or call: Associated Research, Inc., 3758 W. Belmont Avenue, Chicago 18, Ill.**

Firefighting Trailer Is Self-Contained

The steel body of this completely self-contained fire-fighting trailer carries 360 gal. of water. It has four wheels mounted on two level-load axles to provide knee-action and smooth traveling. The low center of gravity makes it practically impossible for the trailer to be overturned even at high speed on sharp turns.

The top sides and fenders are made with steel floor-plate for safety. Mounted atop the trailer body are a high-volume, high-pressure pump, hose reel, 100 ft. of 1-in. high-pressure hose, 150-lb. dry-chemical tank with 50 ft. of hose, 30-lb. hand extinguisher, valves, and all controls. Thirty feet of 2½-in. suction hose is carried in a special compartment at the rear of the trailer.

The valve and piping arrangement is such that in addition to pumping water from the trailer tank, water can be picked up from a pond, reservoir, roadside ditch, stream, or directly from a fire hydrant. Water can also be taken from these sources to refill the tank.

When drawing water from the tank, the pump will throw a stream 100 ft.

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through the 1-in. hose at 80-lb. pressure. The dry-chemical tank is pivot-mounted so that it can be raised to an upright position and latched in place for refilling. The trailer is equipped with electric brakes, rear and side lights, quick-latching safety hitch, and steel-plate fenders. **For more information write or call: Henry H. Paris Distributor, Inc., 1125 Rothwell Street, Houston, Tex.**

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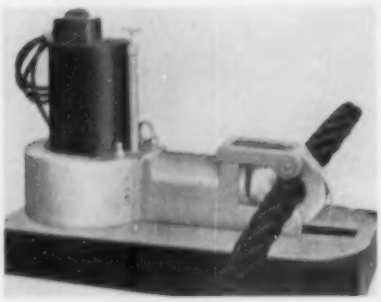
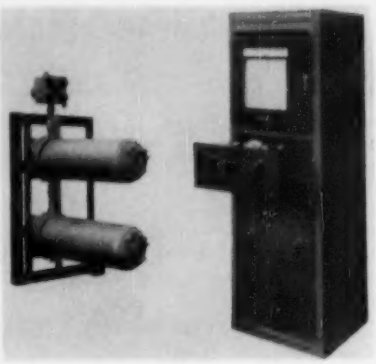


Electric-Driven Cable Cutter Is More Powerful

An improved, extra-powerful electric-driven cable cutter, the Model M, cuts up to and including 2½-in. super plow-steel wire rope in 50 seconds. Powered by a ½-hp., 110/220-volt, single-phase a.c. motor directly connected to a wobble-type hydraulic pump (developing 10,000 psi.), it plugs directly into any electric circuit.

The Model M is furnished with a steel-base plate, skid-mounted for shipping, ready for mounting on dolly, truck, or casters at user's option. It measures 16 in. wide, 33 in. long, with an over-all height of 20 in. It may be bench-mounted or operated at any point where wire rope is to be cut.

This electric unit is simple and effortless in operation, needing no prior experience on the part of the operator. The wire rope is placed into position, the electric switch is closed, and Hydrashear cuts through the rope. When the cut is completed, a mechanical bypass valve goes into operation and there is no further forward travel of the ram. By opening the release valve, the blade retracts and the machine is ready to make another cut. **For more information write or call: Pell Cable Cutter Co., 55 New Montgomery Street, Phone EXbrook 2-2572, San Francisco, Calif.**



Infrared Analyzer Line Includes Wide Range

Four series of Tri-Non infrared analyzers for continuous-analytical control of chemical-process gas streams are now available. The series range in complexity from deluxe models of highest sensitivity and performance for the most complex-processing problems to simpler models designed to monitor relatively simple-process streams.

Series A Tri-Non analyzers offer highest sensitivity, stability, and discrimination, and are completely explosionproof. Series C are not explosionproof. The detector section is connected to the electronics section by a 500-ft. cable. Series D are not explosionproof and all components are mounted in a metal cabinet.

These Tri-Non analyzers are shipped sensitized and adjusted to specific plant-processing problems, since all process plants present unique, individual problems. An installation visit is included in quoted prices. **For more information write or call: Perkin-Elmer Corp., Main Avenue, Norwalk, Conn.**

•

Plug Valve Assures Good Lubricant Distribution

A new lubricated plug valve, designed for 200-lb. oil-water-gas, or 150-lb. steam working pressure, affords: (1) positive high-pressure distribution of lubricant over the entire sealing surface; (2) a self-freeing plug to prevent sticking, and (3) the ease of operation of a cylindrical plug valve.

Other features are: its closely fitted plug and body which prevent seepage of lubricant into line fluids and assure longer valve life; triple-stem seal; double-ball and lubricant-sealed check-valve system; tell-tale lubricant release which shows when lubricant system is full; and its Teflon-floated plug for extra ease of operation and extremely low maintenance.

The valve is available in straight-way, three-way, four-way, and multiple-port types with either 100 per cent area or venturi. It is cast in a variety of metals and alloys including semisteel, steel, brass, aluminum, and ni-resist. **For more information write or call: Homestead Valve Manufacturing Co., P. O. Box 348, Coraopolis, Pa.**

•

Tank Contents Indicator Made for Small Panel Space

A new remote-reading tank-contents indicator designed for applications where panel space is limited is known as Model 216. A dial-type instrument, it has a scale length of 20 in. although occupying a panel space of only 3 by 10¼ in. It is available for either horizontal or vertical-panel mounting.

Model 216 indicator is used with Liquidometer automatic hydraulic-actuated tank-contents gaging systems, approved for gaging hazardous liquids. They are available for many corrosive as well as noncorrosive liquids and for tank pressures up to 200 psi. The gaging system consists of an indicator and a float-type tank unit interconnected by a flexible conduit containing two hydraulic-capillary tubes. The indicator may be located as far as 250 ft. from the tank unit. A completely self-contained hydraulic system provides indi-

cator actuation. No outside power is required.

Where level control is required in conjunction with tank-contents measurement, switches are furnished. The tank unit is installed through a single 2-in. diameter opening in the tank. Once installed, the system requires no further maintenance. **For more information write or call: Liquidometer Corp., 41-03 36th Street, Long Island City 1, N. Y.**

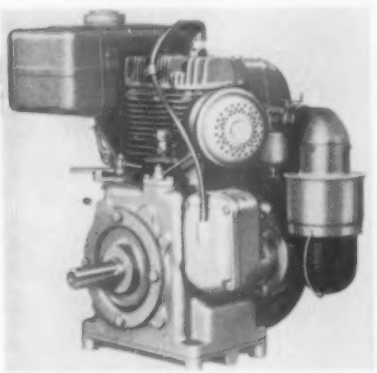
●

Redesigned Engine Gives Increased Horsepower

In the lightweight, four-cycle, heavy-duty engine field, this new engine will represent a substantial increase in maximum horsepower over the single-cylinder Model ABN engine which it supersedes. The new engine, designated the Model ACN, is the smallest engine in a current series of 12 models rated from 5.6 to 36 hp.

The engine has a piston displacement of 14.88 cu. in. and is designed to operate within a speed range of 1,600 to 3,600 r.p.m., delivering from 2.3 to 5.6 hp., with a torque curve of 92 to 104 in.-lb.

The ACN is equipped with tapered-roller main bearings at both ends of



the crankshaft and a gear-driven, high-tension magneto mounted on the outside of the engine and equipped with an impulse coupling for easy starting at low cranking speeds. Positive lubrication is provided by a pump-circulated splash system and the piston is equipped with four rings.

This engine can be supplied with various gear reduction, clutch assembly, or with electric starter and generator, or electric starter alone. It can be equipped to operate on gasoline, kerosine, butane, propane, or natural gas with minimum carburetion changeover. **For more information write or call: Wisconsin Motor Corp., 5249 W. Burnham Street, Milwaukee, Wis.**

Oil and Gas Journal Showcase ..... OF NEW EQUIPMENT

New Commander Features Roomier Cabin

The 560A, a new model of the twin-engine Aero Commander executive aircraft, is bigger and faster than previous models.

The most outstanding comfort feature of the 560A is a longer and roomier cabin. This has been provided by the addition of a 10-in. section in the fuselage forward of the wing.

Aero has placed special emphasis upon the comfort, convertibility, and utility features in this airplane. A hassock-chair may be used to replace the center seats. These chairs have fold-down backs on both fore and aft sides that may be raised from either side to provide a comfortable chair for either forward or rearward seating. By adjusting both backs to a horizontal position, a full length lounge is formed.

The 560A Commander can be converted to cargo use in less than 15 minutes by removing all of the seats. Cargo is easily loaded into the long, unobstructed cabin with its knee-high floor. Hold-down straps attach to the chair rails and fittings. **For more information write or call: Aero Design & Engineering Co., Box 118, Phone WH-9-5474, Bethany, Okla.**

●

Black Magic Now Shipped Without Weighting Material

Black Magic oil-base drilling fluid was made originally in three weight ranges: light (8.02 lb. per gal. or 60 lb. per cu. ft.), regular (9.63 lb. per gal. or 72 lb. per cu. ft.), and heavy (10.7 lb. per gal. or 80 lb. per cu. ft.) It was sacked at the company plant in a complete powdered blend, mainly for simplicity and to eliminate weighting-

Oil and Gas Journal Showcase Coupon

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Please send me complete information on the following item

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Described in the August 8, 1955 Issue of The Oil and Gas Journal

NAME _____ **TITLE** _____

COMPANY _____

ADDRESS _____

CITY _____ **STATE** _____

DATE _____

material calculation and separate supply.

Now, to effect savings in shipping costs and to solve warehousing problems, a universal formula has been developed which is a concentrate containing no weight material. With Universal Black Magic, the operator can add his own weighting material to obtain any desired weight without needing additives for various weights as required in the past.

One sack of universal, when mixed with the proper type of refined oil and the correct amount of water, produces one liquid barrel of Black Magic weighing 7.75 lb. per gal. (58 lb. per cu. ft.).

Universal Black Magic is also available in premixed form. The premix may be obtained either unweighted 7.75 lb. per gal. (58 lb. per cu. ft.) or weighted with either limestone or barite to any desired weight up to 20 lb. per gal. (150 lb. per cu. ft.). **For more information write or call: Oil Base, Inc., 130 Oris Street, Compton, Calif.**

●

Aluminized Fire Suit Designed With Air Pak

A new aluminized fire suit is designed to offer adequate protection for fire-rescue workers. It incorporates an air respirator which enables the worker to breathe for extended periods of time while inside the suit.

The new suit, called the Fire King, is made from aluminized tropic-weight asbestos fabric which reflects up to 90 per cent of the heat generated in the fire. Rescue is thus possible even in direct flame. The lining of the suit is of neoprene-coated fiberglas for additional resistance to heat, abrasion, water, oil, grease, and acids. This also forms an effective vapor barrier. There is a built-in Bullard hard hat to protect the wearer from head blows. A Pyrex vision piece in the helmet is replaceable and is ventilated to prevent fogging.

All outside seams are concealed and inside seams are of flame-proofed tape. A two-way zipper is incorporated into the suit along with takeup springs at the waist and ankles which save time in putting on the suit. It comes packed in a steel case in which the suit can be neatly stored while not in use.

The Scott Air Pak self-contained breathing equipment is a part of the complete suit. The Air Pak is worn underneath the suit and provides enough air for approximately 15 minutes work inside the suit at extreme exertion. The Air Pak offers protection against gas, smoke, dust, or fumes and will operate successfully in temperatures as low as 20 below zero. Also available for use in connection with the suit are fire blankets and extra gloves for helpers who may have to handle hot objects. **For more information write or call: Wheeler Protective Apparel, Inc., 230 West Huron Street, Chicago 10, Ill.**

●

Featherweight Hose Transports Hydrocarbons

A new rough-bore hose, known as the Featherweight, can be used to transport not only gasoline but oil, pure benzole and other chemicals, and water. The new hose, available in a range of bore sizes up to 4 in., shows a considerable saving in weight in comparison with comparable types. The weight per foot ranges from 0.65 lb. for the 1½-in.-i.d., to 2.9 lb. for the 4-in.-i.d. hose.

One major oil company in particular had approached the advisory service for the development of a lightweight oil hose because native labor in the Far East was experiencing difficulties in handling the weight of existing types. The new product not only solves this problem but also has many advantages for use in that country. For example, a road tanker fitted with the Featherweight, can carry up to 60 lb. more fuel per journey than previously because of the saving in over-all weight.

The new hose consists of an inner-exposed supporting wire helix with a fabric liner coated with Molene, which is claimed to be completely resistant to hydrocarbon products. Over the filler of Polysar is a canvas cover coated with abrasion-resistant Molene and a further mild-steel helix. The hose can be used at temperatures up to 200° F. for continuous use, if the flowant permits, or even higher for intermittent use. **For more information write or call: Compoflex Co., Ltd., 26 Grosvenor Gardens, London, S.W. 1, England.**

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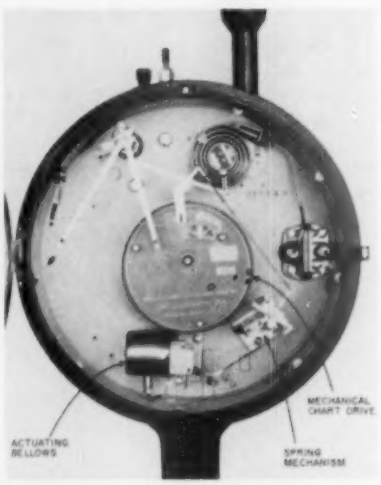

Unit Synchronizes Chart With Intermittent Flows

A new start-stop mechanism drives recorder charts only during periods of actual flow. The device permits accurate recording of intermittent flows on gas lift and other production field operations.

In addition to a mechanical chart drive, only two components are required for start-stop operation: a bellows-type actuator linked to a spring mechanism. The bellows, operated by a pneumatic signal (either 0 to 20 psi.) from the gas-flow intermitter, drives the spring. This, through linkage, trips the chart-drive operating lever to start or stop position. If an intermitter is not available, the bellows is triggered by the recording pen so that the drive starts when the pen leaves zero flow, stops when the pen returns to zero.

With the chart stopped between flows, the record of each period of flow adjoins the previous one, making it possible to compute gas consumption accurately. High-speed chart drives (2, 4, 6, and 8-hour speeds available) spread out the record to improve readability. **For more information call or write: The Foxboro Company, Foxboro, Mass.**

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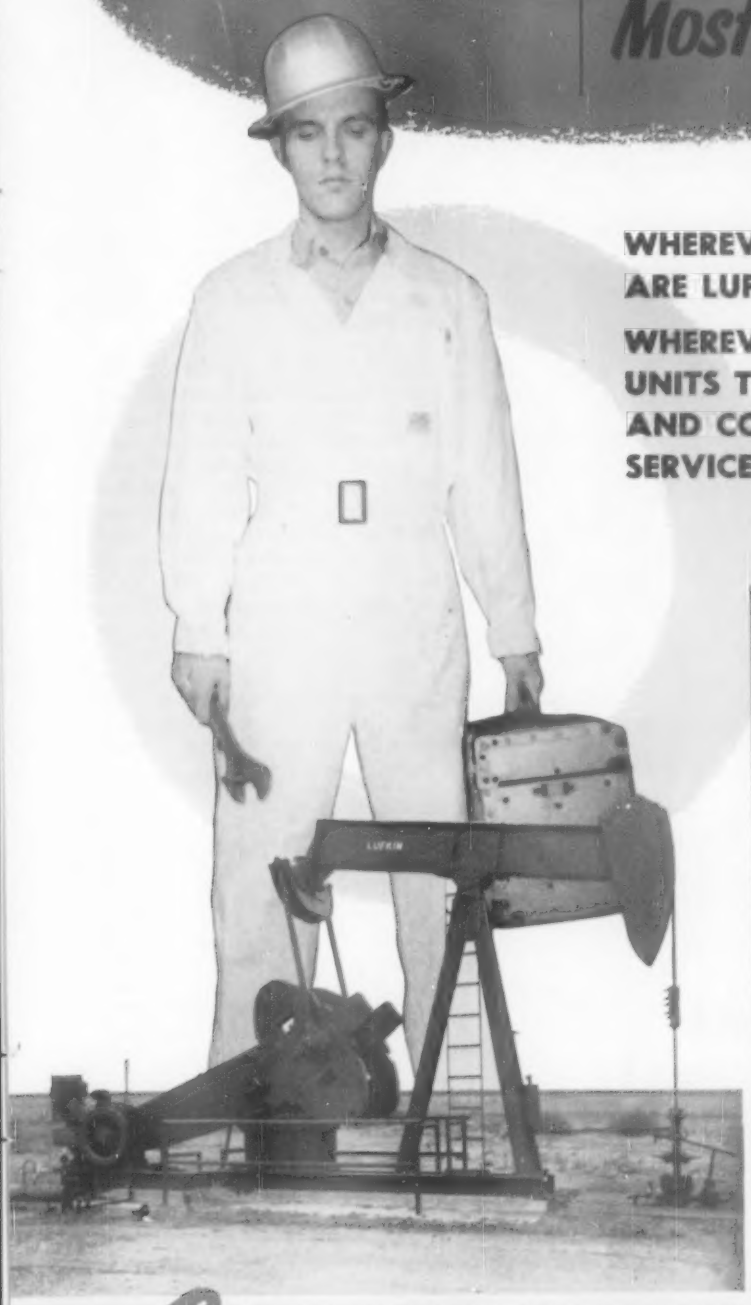

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OIL AND GAS JOURNAL

Showcase

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Small-Size Deaerating Heater designed for use in small steam-generating plants is described in a new technical bulletin. Photographs and cross-sectional diagrams illustrate the sturdy, compact construction of the heater and the versatility of installation. Sizing charts indicate the space requirements, capacity in pounds per hour, amount of storage of deaerated water, and accessories furnished with the heater. **For more information write or call: R. S. Lewis, Advertising Manager, Graver Water Conditioning Co., 216 West 14th Street, Phone, WAtkins 4-2321, New York 11, N. Y.**

•

Oriad Dryers for drying air or gases used to actuate valves and instruments are described in a new bulletin, No. D-101. The bulletin offers condensed specifications, and dewpoint and selection charts. **For more information write or call: C. M. Kemp Manufacturing Co., 405 East Oliver Street, Baltimore 2, Md.**

•

Solenoid Valve Line. These electrically controlled magnetic valves are illustrated and described in a new catalog. The valves are of the solenoid type commonly used to control the flow of water, oil, brine, chemicals, air solvents, gas, and steam. A special section is devoted to comparative tables of fluid discharge and friction drop which makes the catalog an excellent source of reference for engineers and purchasing agents. **For more information write or call: E. W. Brockman, Executive Engineer of Magnatrol Valve Corp., Hawthorne, N. J.**

•

Austin Overshot Loader models are featured in a six-page, three-color catalog which illustrates Models 2-C, 4-C, 6-C, 7-C, and 8-C. Action photos of each model, a detail view of an overshot loader, and photos of hydraulic-system components are shown plus a schematic-piping diagram, condensed specifications, and principal dimensions. These overshot loaders are available in capacities from 1 to 4 cu. yd. and are designed for mounting on Caterpillar D2, D4, D6, D7 and D8 tractors. **For more information write or call: Austin Division, Central Ohio Steel Products Co., Galion, Ohio or 2 Santa Fe Drive, Denver, Colo.**

•

Flexible Hose. A complete set of new bulletins, Nos. 40, 41, 42, 43, and 44 describe the design and installation of flexible hose used in dust and fume control, air conditioning, and handling of materials. General information, friction loss, and other useful data is included. **For more information write or call: Flexaust Co., 100 Park Avenue, Phone ORegon 9-1300, New York 17, N. Y.**

•

Electric, Steam, and Diesel-Driven Pumping Sets. Two data sheets briefly describe pumping sets ranging in capacity from 40 to 2,780 g.p.m. at heads from 25 to 1,811 ft. Typical sets are illustrated. **For more information write or call: George Cohen Sons & Co., Ltd., Wood Lane, London, W.12, England.**

•

The Lee C. Moore 94-Ft. Trailer-Mounted Mast features the portability and versatility of a heavy-duty mast for rugged drilling jobs. Specifications are

R & M's new single-phase "All-Weather" motor—specially designed for oil field use—has a removable "hat" over condensers and centrifugal switch, enabling you to inspect these parts *even while the motor is running.*

This motor takes its "hat" off to you!

The removable cover on R & M single-phase "All-Weather" motors is the latest of many features that make Robbins & Myers Oil Country motors superior. Features like these pay off in profit for you: full-height end-heads that protect internal parts . . . exclusive "weatherizing" that defies the elements . . . "clean sweep" ventilation that keeps motor cool and clean . . . extra-large factory-sealed, pre-lubricated ball bearings . . . screened openings that keep out rodents and debris.

Even with all these features, R & M motors are sold at *standard motor prices.* They've built a wonderful reputation in the oil fields—they'll build a wonderful record for you. Single-phase motors, 1 to 15 HP; open-protected polyphase, 1 to 200 HP. Write for bulletin OG on Oil Field Motors and the name of your nearest R & M representative.

R&M *"All-Weather"* *Oil Country* **MOTORS**

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Springfield, Ohio • Brantford, Ontario
"All-Weather" is an R & M trademark

itemized and engineering drawings show details of the substructure, draw works, mast in drilling position, top section retracted, top section extended, and the T-type substructure. **For more information write or call: Lee C. Moore Corp., Philtower Bldg., Tulsa, Okla.**

●

The Story of Reed. This booklet about the Reed Roller Bit Co., manufacturer of oil-well drilling tools and portable air-powered tools, is designed to provide information concerning the company, its growth, and its position as a manufacturing organization. It includes a history, a listing of products, its marketing facilities, a directory of officers, and a brief description of its research work. **For more information write or call: Reed Roller Bit Co., Houston 1, Tex.**

●

Packaged Compressor Plants. This folder is essentially a pictorial record of skid-mounted, packaged-compressor plants produced by the firm. Brief descriptive data is presented with each picture. **For more information write or call: Stearns-Roger Manufacturing Co., Denver, Colo.**

●

Fibreglass Reinforced Plastics covers characteristics of these plastics, the various types available, moulding techniques, mechanical and physical properties, and casting techniques. **For more information write or call: Fibreglass, Ltd., Ravenhead, St. Helens, Lancashire, England.**

●

Throttltrol—Automatic Valve Positioner. A new bulletin, F 5991-1, describes an automatic valve positioner for use in conjunction with any control instrument having a high and low contact with a neutral position. The Throttltrol automatically and accurately corrects for variations in heat requirements due to changes in furnace load, control settings, air and fuel pressure, B.t.u. values, or combustion efficiency in batch-type operations. The unit is completely self-adjusting and requires no manual adjustments or resetting devices. **For more information write or call: Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill.**

●

Laminated Teflon Pipe, a new four-page bulletin on a line of laminated fluorocarbon-resin pipe, describes the physical and chemical properties of the fluoroflex-T laminated pipe manufactured from woven glass impregnated with Teflon resin. Other data in the bulletin includes piping specifications, a detailed description of flanging and coupling in the field with a special tool, and suggested applications for the chemically inert plastic pipe. The latest price list is inserted in the new bulletin. **For more information write or call: Resistoflex Corp., Belleville, N. J.**

●

Flexible Metal Hose Expansion Joints. A new two-color, eight-page catalog, No. 149, covers lines of Flexon flexible-metal hose and Flexon expansion joints. New specifications are given on the line of expansion joints. **For more information write or call: Flexonics Corp., 1345 South Third Avenue, Maywood, Ill.**

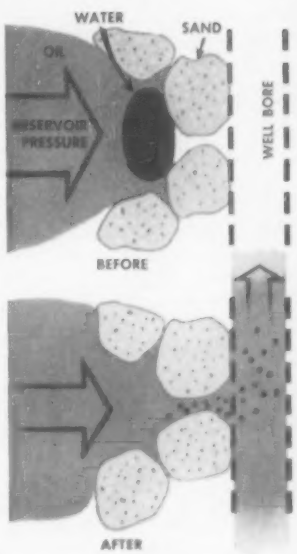
●

Ideal Swivels, Types N-35, N-47, and N-69, three of the six sizes in a new line, are presented in three new eight-page bulletins, Nos. 451, 450, and 449, respectively. These swivels are usually selected when drilling between 3,000 and 9,000 ft. Design features and specifications are given. **For more information write or call: National Supply Co., One Gateway Center, Pittsburgh Pa.**

●

Improve Oil Production with PR-277

a surface-active agent for use in water-block removal



PR-277 removes water blocks by lowering the oil-water interfacial tension which causes the water droplets to lose their rigidity and allows the oil to flow.

Aquaness has developed PR-277 to stimulate well production by removing water blocks and solving problems caused by water.

Recently, seven poor producing wells were treated with PR-277. Only 196 gallons of this chemical were used, resulting in a total *daily* oil production increase of 165 barrels.

The added daily production paid for the total chemical cost in slightly over two days' production at the increased production rate.

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Gentlemen: Please send me additional information on PR-277.

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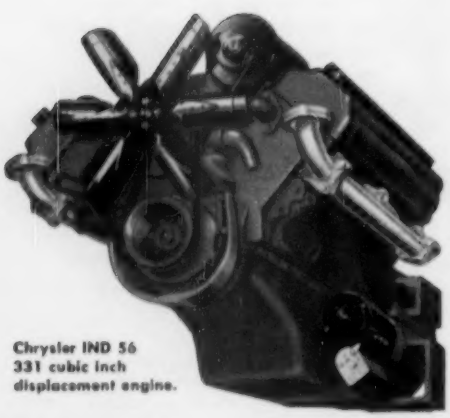

Chrysler IND 56 331 cubic inch displacement engine.

Wherever your lease—Texas, Louisiana, Kansas, California, Pennsylvania or North Dakota, there's a Chrysler Industrial Engine Service Dealer near you, factory-trained and well stocked with authorized Chrysler parts and accessories. And—what's important, too—no Service Dealer is more than a day away by air or fast freight from a Chrysler Parts Warehouse. Specify dependable Chrysler Industrial Engines and Power Units—gasoline, distillate, natural or L/P gas burning—for any of 101 different jobs in Petroleum. 230 to 413 cubic inch displacement. For information or catalog write ***Department 158, Industrial Engine Division, Chrysler Corporation, Trenton, Michigan.***

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HORSEPOWER WITH A PEDIGREE

EQUIPMENT MEN . . . in the News

Failing Names Floyd To Manage Midland Branch

A. G. FLOYD

The appointment of A. G. (Bud) Floyd as manager of the Midland, Tex., branch of the George E. Failing Co., Enid, Okla., manufacturer of portable drilling rigs, has been announced by J. T. Tucker, general manager of sales for Failing.

Floyd, who has been working out of Failing's Houston branch as a sales engineer, replaces Jimmy Helton at Midland. Helton has been transferred to Edmonton, Canada, as manager of all Canadian operations for Failing.

Dendy Made Assistant District Engineer

J. C. DENDY

The appointment of James C. Dendy as assistant district engineer, machinery and equipment sales and service, at Greggton, Tex., for U. S. Steel's Oil Well Supply Division was announced today by William Miskimins, Central Midwest area manager.

Dendy was employed by Oilwell at Hobbs, N. M., in 1953 as an engineer trainee. In 1954 he was transferred to Greggton to serve in the same capacity. Dendy was located at Greggton prior to his present appointment.

Norris Names Preston To Head Wichita Office

R. L. (Red) Preston has been appointed to head the new Wichita, Kans., office of W. C. Norris Manufacturer, Inc., Tulsa, oil-equipment producer.

Preston was previously with Sinclair Oil Co., Hinderliter Tool Co., and was formerly district manager for Pacific Pumps, Inc., in Great Bend, Kans.

The new Farris Engineering plant at Houston is equipped with all necessary facilities for the manufacturing and servicing of safety and relief valves, pinch-type f exible valves, X-V series of disk-type valves, diesel-engine governors, and other products.

Farris Establishes Houston Manufacturing Plant

As part of a general expansion program covering both its manufacturing and sales facilities, Victor W. Farris, president of the Farris Engineering Corp. and its affiliates, Palisades Park, N. J., has announced the establishment of a new plant in Houston. At the same time, announcement has been made of several new staff appointments within the Farris organization.

Promoted to manager of the new Farris Houston plant is Edward Groth, Jr., formerly with the Farris Stacon Corp., another affiliated company. Groth has been associated with the Farris organization since 1949.

Sales and operational personnel of the Farris affiliated companies has been greatly expanded. These include two new sales managers and several area managers who will augment 53 Farris sales offices throughout the United States and Canada.

Appointed as sales manager for the Farris Flexible Valve Corp. is Charles W. Hanlon, with 17 years of experience in the sale and manufacture of equipment for the petroleum and chemical industries. New area managers include:

EDWARD GROTH

C. W. HANLON

Charles S. Lewis, covering the Midwest sales offices with headquarters in Chicago; Albert F. Stumm for the mid-Atlantic states, with headquarters in Philadelphia; and Groth for the Southwest in addition to his other responsibilities in the Houston plant.

McCullough Boosts Erwin To Division Management Post

N. H. ERWIN

N. H. (Nate) Erwin has been promoted from Pacific division service manager to general service manager, Pacific and Mountain divisions, with headquarters in Los Angeles, according to I. J. McCullough, president of the McCullough Tool Co.

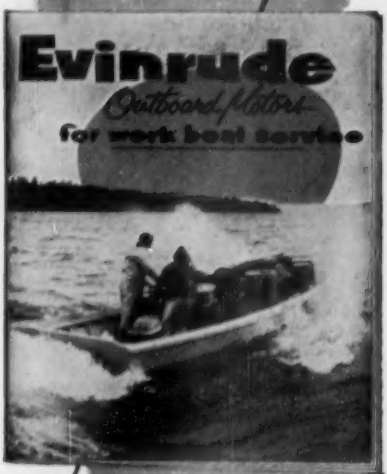
Erwin has had 32 years' experience in the oil industry and 18 years with McCullough Tool. He embarked upon a career in oil in 1923 as a roughneck at Maircopa Flats, Calif., and joined McCullough in 1937 at Los Angeles. In October 1937 he went to Corpus Christi, Tex., as branch manager and then served successively as district manager in New Iberia, La., Mount Vernon, Ill., and Oklahoma City. Erwin returned to the company headquarters in Los Angeles in 1943 as field superintendent and became Pacific division manager in 1946.

Nelson Appoints Brown As Factory Representative

Tom Brown has been promoted to the new position of factory sales representative, it has been announced by Nelson Electric Manufacturing Co., Tulsa.

Brown, who has been working out of the Tulsa office as a sales engineer for

new book



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Division of Outboard, Marine & Mfg. Co.
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4 years, will be working with each of the 35 district sales offices maintained by Nelson and assisting the district offices in contacting and servicing Nelson customers.

During the 4 years Brown has been at Nelson he has seen many of the Nelson products developed in the engineering department.

Borg-Warner, Byron Jackson Merger is Proposed

The proposed merger of Borg-Warner Corp. and Byron Jackson Co. will be accompanied by immediate and long-range expansion in the electronics, petroleum, and other industries.

The purchase by Byron Jackson Co. of 38½ acres in Santa Ana for the construction of a highly modern electronics plant, including one of the few private electronics testing laboratories on the Pacific Coast, was announced by E. S. Dulin, president of that company.

Satisfactory and "more rapid than expected" progress on the development of a new sonic oil-well drill was revealed by Roy C. Ingersoll, president and chairman of the board of Borg-Warner. The drill, developed by the Petro-Mechanic Research Division of Borg-Warner in North Hollywood, is now being operated experimentally in Ventura.

A proposal for the merger of the two concerns, already unanimously approved by their two boards of directors, will be submitted to a vote of the stockholders of Byron Jackson at a special meeting called for August 23 at the company's office in Vernon. Consummation of the transaction awaits only favorable action at this meeting.

The merged companies would have total assets of $298,248,642 and working capital of $132,449,568. Combined sales volume should approximate a half-billion dollars.

E. S. Dulin, president of Byron Jackson Co., and Roy C. Ingersoll, president and chairman of the board of Borg-Warner, shake hands on proposed merger of the two companies.

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A. W. Carroll Named Otis Staff Assistant

A. W. Carroll has been appointed a staff assistant in the engineering department of Otis Engineering Corp., Dallas, manufacturing affiliate of Otis Pressure Control, Inc. He formerly was liaison engineer. Carroll began with Otis in 1940 as a helper in New Iberia, Brookhaven, and Houma. He also was assistant superintendent in New Iberia and caliper department superintendent in Houston.

Lane-Wells Opens Three Branches in Gulf Coast

Three new branches have been opened by Lane-Wells Co. in the Gulf Coast division, bringing the total number in that division to fifty, according to J. M. Henderson, Gulf Coast division manager.

A sales office was established at El Campo and B. A. Jones has been assigned there as district sales engineer. The Beaumont branch has been moved to new facilities on West Calder Road, Amelia Addition.

A new truck station has been established on Highway 80 West in Sweetwater, Tex., and J. R. Ross is station superintendent there. The base at Winters, Tex., has been closed and the equipment and personnel transferred to Sweetwater.

A new truck station has been opened at El Dorado, Ark. Burt R. Brashier has been transferred from Magnolia, Ark., to El Dorado as operator in charge.

Ted E. Brisbin, rigman at Wichita Falls, Tex., has been appointed district sales engineer and reassigned to Abilene.

Hoffman Joins Chicago Bank as Vice President

Milton C. Hoffman, for many years associated with Stanolind Oil & Gas Co., Tulsa, has been elected a vice president of Continental Illinois National Bank & Trust Co. of Chicago, in which capacity he will be active in the field of oil and gas financing.

Hoffman has spent his entire business career in oil and gas activities. In 1919 he joined the Midwest Refining Co. at Casper, Wyo., and held various engineering and supervisory positions in the Casper refinery and Salt Creek oil fields. This was followed by several years as district manager of gas operations for Montana-Dakota Utilities Co. In 1931 he entered the employ of Stanolind where he held the positions of gas engineer, division engineer, chief production engineer, general superintendent, and Canadian division superintendent. As a vice president and director of Standard's Pan-Am Southern Corp., during the period 1949 to 1954, he was in charge of that company's exploration, production, and pipeline activities.

Texas Instruments Names CDC As Canadian Agent

Texas Instruments, Inc., Dallas, has announced the appointment of Computing Devices of Canada, Ltd., Ottawa, Ont., as its exclusive Canadian agent.

Arrangements were completed recently in Ottawa by S. T. Harris, TI marketing vice president, and C. F. Hembery, CDC president.

The appointment of a Canadian agent, combined with the opening of U. S. district sales offices, will give Texas Instruments local representation over the North American continent.

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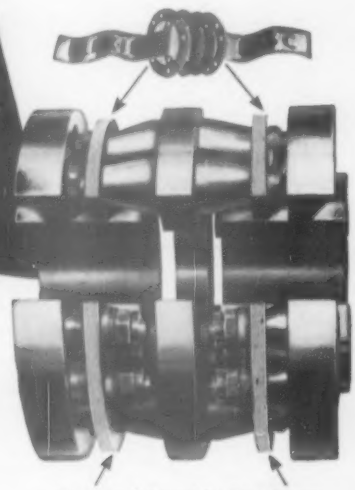

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NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
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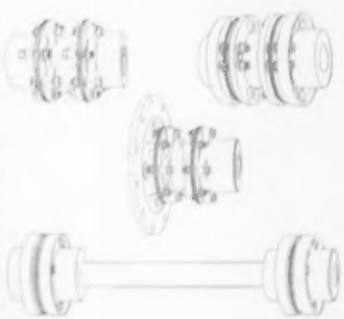

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EXPLORATION

Salt Domes—A Geological Enigma

by Frank J. Gardner

DID YOU KNOW? . . .

There are 209 piercement salt domes in coastal and eastern Texas, Louisiana, Mississippi, and Alabama?

That every one of them is expected to produce oil some day?

That only 106 of these, or just about one-half, have produced oil or gas so far?

That the average depth to the salt (over all) is 2,000 ft. or less?

That 25 of the productive domes produce from above the salt, 54 from the flanks and 27 from both?

That the salt cores are found at depths from 230 to 11,365 ft., and that in a few domes, surface mining is carried on in the outcropping cap rock?

Most of these domes are less than 15 miles from a producing field?

That neither drilling nor subsurface study is under way on most of them?

HAVE YOU REALIZED? . . .

That many piercement domes have important production on the flanks and none on or above the salt and cap rock?

That the presence or absence of oil above the salt apparently has no bearing on its presence on the flanks?

Most people assume that the flanks of all salt domes have been completely explored?

That Spindletop still contributes important new pools every year?

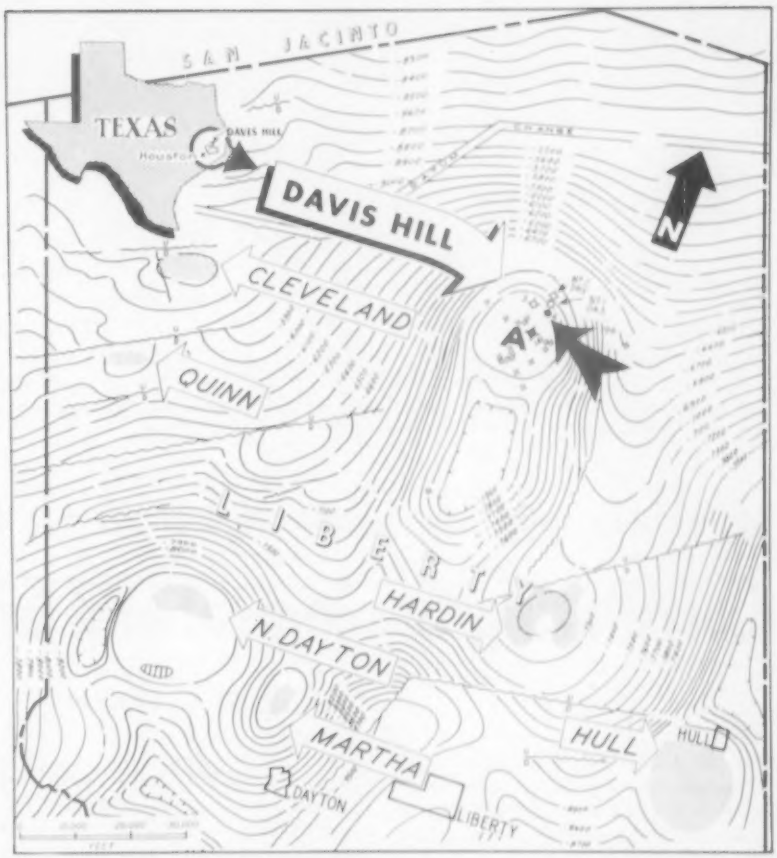
That hundreds of millions of barrels of new reserves have been discovered since 1945 on these long-known domes?

That the majority of this oil was found by detailed subsurface geological study and through new knowledge of salt-dome mechanics?

That salt-dome geology is the most difficult form of subsurface geology?

Geophysics can add little to geological knowledge of piercement salt domes?

That these domes are larger in size and regional effect than geologists ever dreamed?



Subsurface structure of Liberty County, Texas, showing principal salt-dome uplifts. Contours on Cockfield-Yegua and Wilcox formations. The first commercial oil well on Davis Hill salt dome is indicated by black arrow. (Map base courtesy Coastal Geological Service, Houston.)

That somewhere on or around a piercement salt dome, it is possible to find every known type of oil trap?

HAVE YOU HEARD? . . .

The deepest production in the world is on a piercement salt dome flank at Weeks Island, Louisiana, at 17,554 ft., and that geologists expect production clear down to 30,000 ft.?

That actually very few of the 103 nonproductive piercement salt domes have seen any deep flank exploration?

That the prospective and potential areas yet to be explored on domal flanks may exceed all presently known productive areas?

IF SO . . .

Then you were not surprised to hear that The Texas Co. 4 Wirt Davis (black arrow on map) has opened oil production for the first time on the old Davis Hill piercement salt dome with a flow of 185 bbl. of 46.1°-gravity oil from a flank sand at 6,768-88 ft. Here is a prime example of what we've been talking about. For 50 years, Texas Gulf Coast oil finders have been probing this Liberty County prospect. They found the dome in 1905. It's evident at the surface, and there were gas seeps around it. So they drilled it, and found cap rock at 800 ft., salt at 1,200 ft. But no oil — only showings and noncommercial tests (Example: A on map). Trouble was, nobody went deep enough; the deepest hole until recently was 5,160 ft.

Then The Texas Co. in 1954 started its four-well deep-drilling program on the Wirt Davis estate. The 1 Davis was a small gasser—741 M.c.f. per day from sand at 3,548-70 ft. in June 1954. The second test, 2 Davis, was dry. So was 3 Davis. Operators then staked the fourth well to the south of No. 1 and found a new oil pool. That's just an illustration of how fine one must split a hair in salt-dome exploration. The discovery well was carried to a new record of 9,106 ft. and plugged back before completion.

The salt dome is a challenging enigma to the Gulf Coast geologist. It's doubtful it ever will be explained in its entirety, for, as in all Nature, there are no two domes exactly alike.

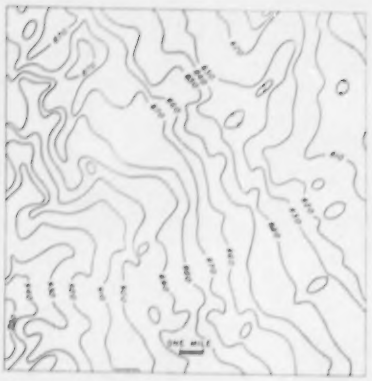


Fig. 1—Reflection time to top of Lower Cretaceous. (Contour intervals 10 milliseconds).

Fig. 2—Final velocity contour map. Circles indicate all available wells.

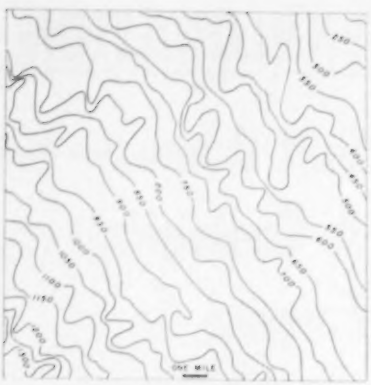


Fig. 3—Structure contours recorded on the Lower Cretaceous.

Here's why, and how, exploration staffs can succeed in

Correlating Geological and Geophysical Data

by D. C. Skeels

CORRELATION of geological and geophysical data should mean something more than the mere inclusion of geological and geophysical maps in the same report.

The geological data should be used to check, evaluate, and help interpret the geophysical data in geological terms. Similarly, the geophysical data should be used to fill in gaps in the geological control—especially to provide control at depth. The final result should be a map or a series of maps and sections which should take into consideration all of the data and which is inconsistent with none.

How do we achieve this correlation between the two kinds of data?

In the first place we must recognize that not all geophysical anomalies are related to geological structures, as we ordinarily use the term. If possible, we must learn to distinguish the significant from the nonsignificant anomalies.

In the second place, we must, where possible, determine the physical properties of the rocks, such as density and seismic velocity, in order to be able to translate the geophysical data into geological terms.

Finally, we must have and make use of a background of geological knowledge and, most important of all, geological imagination. This third requirement is most important in the interpretation of reconnaissance surveys, where few geological data are available. But it also plays a part in all stages of interpretation.

Author is with Imperial Oil, Ltd., Edmonton, Alta. This is an abridged version of a paper presented before the Fourth World Petroleum Congress; copyrighted 1955 by Carlo Colombo, Rome.

Seismic data . . . The seismic method has had such a spectacular success in petroleum exploration that we sometimes forget the seismograph does not give geological information directly. It gives only time-distance relationships which can be interpreted in terms of geology, providing certain conditions are fulfilled and certain other data are available. Much of what passes for seismic interpretation is really computation, with little reference to geological data.

Velocity maps . . . Once the identity of a reflection at a well has been established, providing the reflection is continuous over a large area, the velocity at another well can be computed by simply dividing the depth to the reflecting horizon by one-half the reflection time (both depth and time are referred to the same datum, of course). Thus it is not necessary to shoot every well in an area to obtain a velocity map.

These velocity maps often show a great deal of variation. Their study is recommended as an antidote to the tendency to which all of us are prone—to regard seismic time contours as structure contours without further qualifications.

Mapping in Canada . . . These last remarks can best be illustrated by an example. Fig. 1 shows a map of seismic reflection times to the top of the Lower Cretaceous in an area in western Canada. The reflection on which this map is made is exceptionally strong and persistent, and there is little question about the correlation. The map is based on a seismic value for every section corner, that is, one per square mile.

In the area covered by the study, which is 3,200 sq. miles, there are 183 exploratory wells which have drilled to or below the top of the Lower Cretaceous.

By a series of calculations, we figure a final velocity map (Fig. 2) using all 183 wells and compute new seismic depths from this map. Contouring these depths, we obtain the seismic depth map (Fig. 3). Of course, this map agrees with the geological depth of each of the wells. Between the wells, the depth is based on seismic data and on the velocity distribution determined from the wells. Essentially therefore, we are using seismic data to introduce the depths between the wells.

A comparison of the seismic time map with the final seismic depth map shows that the former has considerably more relief than the latter, and that this relief is due largely to variations in the velocity within rather small distances. In this example, the velocity variation has no geological relation that we can determine.

Reef mapping . . . In some cases, however, a velocity change within the sec-

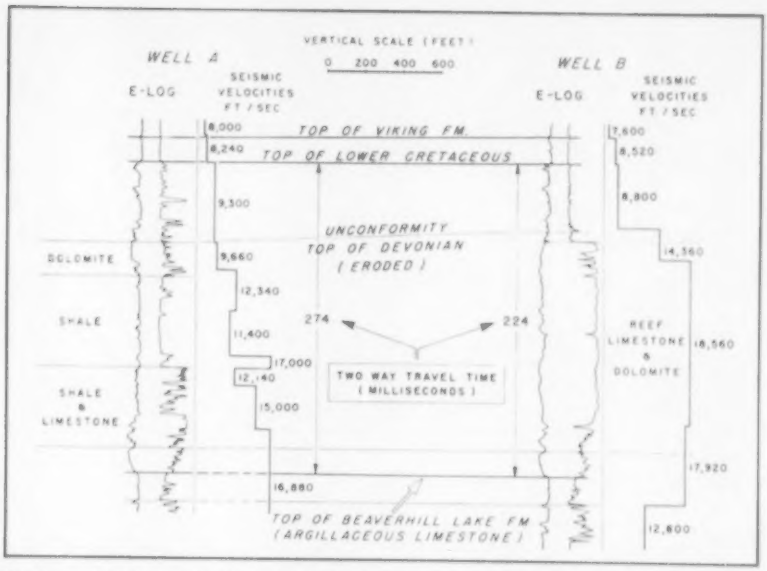


Fig. 4—Electric logs and seismic interval velocities (for adjacent wells, one on reef and one off reef).

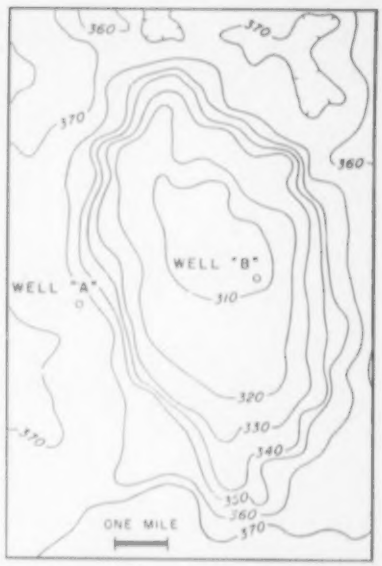


Fig. 5—Time interval between the Lower Cretaceous and Elk Point reflections.

tion can be related to a definite change of facies and has a direct bearing on oil accumulation. This is the case with the Devonian reefs in Alberta.

Fig. 4 shows electrologs and velocity logs for two wells, one on-reef and one off-reef. The electrologs are quite similar at the top and bottom of the section, but in the middle part we find a section that is predominantly shale in one well replaced by solid reef limestone and dolomite in the other. The seismic velocities in the reef section are considerably higher than in the shale section, and the total two-way travel time in the interval between the Lower Cretaceous and the Beaverhill Lake formations is less in the reef section than in the shale section by as much as 50 milliseconds, due to the greater velocity.

Therefore, if we can map two seismic reflections, one from above and one from below the reef, and plot the time-interval (the difference between the two reflection times), the position of the reef will be indicated by a time minimum.

Fig. 5 is such a time-interval map for the area including the two wells of Fig. 4. It shows the difference in time for reflections from the Elk Point formation, well below the reef, and the Lower Cretaceous, well above. The outline of the reef is clearly shown by the area of closure. Knowing the velocities of reef and off-reef shale facies, it would be possible to predict the thickness of the reef from this time-interval map.

This particular reef is nonproductive. But had Well B been a producer, it is obvious that the seismic map would have been of very great assistance in developing the field. In fact, similar maps are being used extensively in the development of the reef fields of Alberta.

Conclusions

This paper has tried to show the need for a real fusion of geological and geophysical data and thought to produce a better picture of geological conditions below the surface than can be obtained from either kind of data separately. Whether the one who does the correlating calls himself a geologist or a geophysicist is immaterial. But it is essential that he understand the language of both professions.

Perhaps the reason that we do not have enough correlation at present is that we do not have enough men who have a thorough background in both geology and geophysics—we are overspecialized. This situation could be improved by giving young geologists and geophysicists some training in both departments. It could also be improved by a closer liaison between the two departments.

EXPLORATION HIGHLIGHTS

APPALACHIAN

PENNSYLVANIA

Gaskill Township, Jefferson County, Southwest Pennsylvania. Columbian Carbon Co. 1-1830 Harriet C. McClure, wildcat, is drilling at 973 ft.

● Kiskiminetas Township, Armstrong County, Fred M. Schreckengost et al. 1 Wm. Schreckengost is at 5,240 ft.

WEST VIRGINIA

In Greenbank district, Pocahontas County, West Virginia, Columbian Carbon Co. is grading the roadway to the location for a rank wildcat 1220 United States of America a part of tract No. 34, elevation 3,205 ft., Durbin Quadrangle 1.00 mile south of latitude 38 degrees 40 minutes and 1.20 miles west of longitude 79 degrees 45 minutes.

● Licking district, Tucker County, Hope Natural Gas Co. 9940 James E. Watson, elevation 1,809 ft., is now drilling in the Oriskany sand at 4,738 ft., which was topped at 4,695 ft.

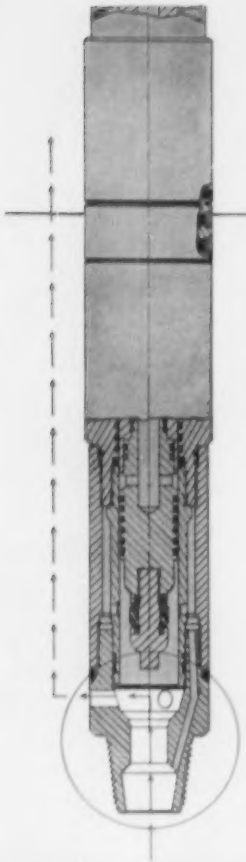
● In St. George district, Columbian Carbon Co. 1 U.S.A., is drilling at 3,464 ft.

● Glade district, Webster County, Wainville Gas Co. 1 Cary C. Hines is at 1,265 ft.

OHIO

The old production at Cottage Hill in Hopewell Township, Muskingum County, was extended ½ mile southeast by Hartley Crumball et al with a well on 1 W. O. Burrier, Section 7. Clinton sand at 3,285-3,328 ft. made 200 bbl. in a 24-hour-test after fracture.

● Conneaut field was extended south



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The very nature of sealing a rubber packer in open hole requires that clearance between packer and well bore be kept to a minimum. If tight spots are encountered going in hole, there's a possibility of having no clearance at all. Halliburton's By-Pass allows fluid to pass through packer and saves much down time... damage to formation below the packer and to the wall of the hole is greatly reduced.

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⅔ mile with one of its largest open flow gassers. The R. McConnell et al 1 H. Johnson, Lot 4, Monroe Township, Ashtabula County, gaged 550,000 cu. ft. natural and 4,000,000 cu. ft. after fracture.

● Sun Oil Co. is drilling below the St. Peter on the first of three wells to test the Cambrian sands in western Ohio. This first test is on 1 Robert Levering, Section 3, Washington Township, Miami County.

EASTERN INTERIOR

KENTUCKY

New Bulletins Released By State Geological Survey

"Geology and Mineral Resources of the Newburg Quadrangle, Kentucky," by Joseph B. Cathey, Jr., has been released as Bulletin No. 15 by the Kentucky Geological Survey at Lexington. The state survey is publishing this bulletin as one of a series being prepared under funds provided by the Agricultural and Industrial Development Board. The area covered in this report is located in Henderson and Daviess counties, western Kentucky. The report covers a study of essential geological conditions and an analysis of mineral resource development and possibilities. These include petroleum and gas, coal, clay, sand and gravel, and limestone.

"Geology of the Morganfield South Oil Pool, Union County, Kentucky," by E. Boyne Wood, is issued as Bulletin No. 14. This report is one of a series planned to cover the oil and gas pools of the Western Coal Field in an attempt to determine the controlling geology of each pool. This then becomes a basis for more efficient prospecting and a contribution to the better understanding of oil-field geology. . . . Statements by Arthur C. McFarlan, Director of the Kentucky Geological Survey.

New Pool, Muhlenberg County

Skiles Oil Corp. opened a new pool in Muhlenberg County, Kentucky, this past week. They completed, within a period of 12 hours, two flowing wells near the town of Greenville.

The 1 Chandler flowed 60 bbl. from the Benoist sand in 19 hours, having bottomed at 867 ft. A few hours later the 1 Hardison, on the opposite side of the same 800-acre block, started to flow from 14 ft. of Benoist bottomed at 887 ft.; in the first 24 hours this well produced 167 bbl.

These producers are the first results of over 2 years of concentrated work in this area of Kentucky by a team of Skiles geologists and landmen who have put together a number of blocks, totaling over 9,000 acres, in this general area.

Three more Skiles wells are now drilling on these recently acquired properties.

GREAT LAKES

ONTARIO

Five Wells Slated For Southwest Ontario

Five wells will be put down in the southwestern part of Ontario by Canadian British Empire Oil Co., Ltd., on lands held by Pan Western Oils, Ltd.

The first of these wells is spudded. It is the 11-11 Logan, Lot 11, Concession 11, Logan Township, Huron County. When these five wells are completed Canadian British Empire will have 50 per cent interest in about 17,000 acres held by Pan Western Oils, Ltd., all located in Huron County.

MICHIGAN

A well that appears as the best well drilled in Reynolds field, Montcalm County, to date, and the possible extender of the pool to the southeast was being tested at the McClure, Basin, Swan-King Oil Co. and G. Ackerman 1 Underwood, et al, SE NW NE 12-12n-10w, Reynolds Township.

This new producer logged Dundee top at 3,235 ft. and pay level was just tapped at 3,328 ft. Well filled and started to flow natural within 40 minutes. Structurally, the 1 Underwood et al is the highest producer drilled in the field, on both Dundee top at Reed City zone pay.

This important extender, which appears to open a vast new area to drilling on the southeast side of the pool, also appears to establish the presence of a saddle between the Kohn lease and the 1 Underwood. On the basis of information established by this well, Reynolds pool could now extend to the southeast to cover more area than has been drilled and proved in this pool to date. The bulk of the acreage in the area that now appears likely is under lease to the group that drilled this well and all other producers in the pool. The Reynolds pool is being developed on a 40-acre well spacing pattern, one of the few pools to be drilled on this pattern for Dundee-Reed City zone production since World War II spacing regulations were relaxed.

MID-CONTINENT

NORTH TEXAS

Dual Discovery Finaled In Wilbarger County

A deep field test in Wilbarger County came up with discovery in two zones. Tom B. Medders 1-D W. T. Waggoner, southeastern part of the county, was completed in the Reef lime at 3,918-3,936 ft. and from the Strawn at 3,770-76 ft.

From the Strawn the well made 227 bbl. of oil per day on 24/64-in. choke, 36° gravity. This gaged was based on a 13-hour flow of 123 bbl. The calculated 24-hour potential from the Reef lime was 432 bbl. of oil per day on 40/64-in. choke, 36° gravity. The well is located in Section 33, Block 4, H&TC Survey.

Northwest Young County Gets New Strawn Pool

A new Strawn pool has been opened in the northwest part of Young County. The discovery well belongs to Joe K. Bailey and W. A. Lofton et al. The 1 B. W. King flowed 241.70 bbl. of oil per day through a ¼-in. choke, gravity being 40°.

The well was completed in open hole section with total depth at 3,609 ft. The Strawn zone tested was at 3,584-3,609 ft. This well is in the TE&L Survey 735 A-740.

OKLAHOMA

Sterling Completes Oil Pool Discovery Well

Sterling Oil of Oklahoma, Inc.'s 1 Rogers well in SE¼ NE¼ SW¼ 17-23n-4w, Garfield County, Oklahoma, has been completed in the first Wilcox sand. The oil string, 5½-in. casing, was run to 6,217 ft. and cemented with 100 sacks of cement. Mechanical difficulties delayed the completion for a month but after perforating from 6,100-22 ft. the well commenced flowing at the rate of 164 bbl. per day, natural.

The Oklahoma Corporation Commission has given a special temporary testing allowable of 150 bbl. per day for 30 days, since this is a discovery well.

The Mississippi lime zone, from which Sterling has 16 producing wells to the south, is also present in this well and possible dual completion is contemplated.

Hunton Lime Shows Reported At West Short Junction Well

A northwest extension try to Cleveland County's prolific West Short Junction field, southwest of Oklahoma City, reported shows of oil in the Hunton lime.

The well, Stanolind 1 Roztocil, C SE SE 8-10n-4w, is testing the Bois d'Arc lime after swabbing 6 bbl. of oil in 5 hours from the Hunton lime at 8,175-80 and 8,185-90 ft.

Field activity . . . In West Short Junction field itself Continental Oil Co. 1 Wallace has been completed for a flow of 857 bbl. per day on ½-in. choke with 630 M.c.f. of gas. This well, located in C NW NW 22-10n-4w, flowed from Hunton lime perforations at 8,146-8,212 ft.

Sun Oil Co. has completed its 1 Maruska, C SW SW 15-10n-4w, flowing 486 bbl. per day on 1-in. choke. This well is a Hunton producer and further expands the field.

Oil shows were reported at Stanolind Oil & Gas Co.'s northwest extension try in West Short Junction field area, Cleveland County.

Development Interest Shifts To West Chitwood Area

One of the most interesting wells drilling in Oklahoma is Frankfort Oil Co.'s West Chitwood extension prospect, the 1 Mutz in SE NW NW NW 24-5n-7w. This discovery prospect had indicated production from more than one sand. Its success will undoubtedly speed up drilling in this area of Grady County.

The well flowed 10 bbl. of oil hourly with 150 M.c.f. of gas, natural, on a test of the upper sand at 9,852-66 ft. Later, after fracturing, the well flowed 120 bbl. of load in 6 hours, 192 bbl. load and 168 bbl. of new oil in 12 hours on ½-in. choke. The well, located 1 mile west of the field, is now ready for production tests in a lower zone with casing set at 10,644 ft.

Central Committee for the regional A.A.P.G. meeting sponsored by the Oklahoma City Geological Society to be held in that city on November 2, 3, and 4, 1955. Left to right: Joe M. Sears, B. Osborne Prescott; Robert F. Dewey; Wm. M. Decker; Louis R. Wilson.

Mid-Continent A.A.P.G. Sets November Dates

A regional A.A.P.G. meeting sponsored by the Oklahoma City Geological Society in cooperation with the Mid-Continent Council of Geological Societies will be held in Oklahoma City, November 2, 3, and 4, 1955.

Acting as co-hosts are the Ardmore Geological Society, Panhandle Geological Society, and the Shawnee Geological Society. Registration begins Wednesday, November 2 at convention headquarters, the Skirvin Tower Hotel.

Technical meeting, dwelling on the subject of the Permian and Pennsylvanian of the Panhandle and Mid-Continent areas, will be held on Thursday and Friday, November 3 and 4. Abstracts received indicate a most comprehensive and interesting resume of the oil producing horizons in these areas will be heard.

Activities other than the technical papers will include a social hour, breakfast dance, and other entertainment. A field trip through the Arbuckle Mountains of South Oklahoma is planned. This will be led by W. E. Ham of the Oklahoma Geological Survey.

Other committee chairmen in addition to the Central Committee (see photo) include: L. A. Puzin; W. S. Martz, Jr.; Richard L. Roberts; J. W. McHugh; John F. Roberts; Eugene F. Culp; Stewart A. Hoge; Mrs. John M. Ware and Mrs. F. A. Roberts.

HUGOTON EMBAYMENT

TEXAS PANHANDLE

Hansford Morrow Extension Discovery Completed

Stanolind Oil & Gas Co. 1 Hitchland Gas Unit, 1 mile south of United Producing Co. 4 Lola Jackson, 6 miles south of Hitchland, north-central Hansford County, made 9,153 M.c.f. of gas daily from the Morrow sand at 6,612-16, 6,676-82, and 6,688-92 ft.

Northeast discovery . . . In the northeastern part of Hansford County a new Morrow sand gas field has been opened at Lamar Hunt Trust 1 Charles O'Laughlin, 10 miles northeast of Spearman in Section 59, Block 45, H&TC Survey.

The discovery well flowed 1,400 M.c.f. of gas per day, natural, from perforations at 7,094-7,106 ft. on 1-in. choke.

OKLAHOMA PANHANDLE

Southeast Beaver Discovery Reports Big Gas Flow

Union Oil Co. of California has one of the outstanding gas discoveries of the year for the embayment. The 1 James W. Parker, 8 miles northwest of Elwood in a rank wildcatting area of the Oklahoma Panhandle, flowed gas calculated on tubing at 20,500 M.c.f. per day or an estimated open flow of 150,000 M.c.f. daily.

The off-the-beaten-path wildcat discovery is producing from perforations in the Morrow sand at 7,096-7,110 ft. The well is 6½ miles southwest of Southwest Camp Creek field, a Douglas and Morrow sand producer. It is the first deep test in this section of the country.

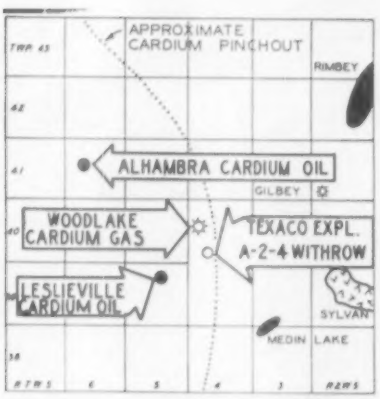
WESTERN CANADA

ALBERTA

Texaco To Drill Wildcat Northeast of Leslieville

Texaco Exploration Co. has staked location for an important test in the Leslieville area at A-2-4 Withrow, LSD 2, 4-40-4w5, 15 miles southeast of Cardium oil production at Alhambra and 12 miles southwest of Gilby Viking and Mississippian production.

Texaco's new try is 3½ miles southeast of Woodlake Cardium gas field and northeast of Leslieville. Alhambra, Leslieville and Woodlake are three important Cardium discoveries some distance southeast of Pembina. All three are located near the expected pinchout line of the Cardium. Texaco's wildcat will go down on a 6,761-acre Crown Reservation bought June 1 for a cash bonus of $250,125.



An important wildcat will go down in the Withrow area, 15 miles southeast of Alhambra-Cardium field. It will be the Texaco Exploration Co. A-2-4 Withrow.

Windfall Discovery Makes Another Recovery

The latest drill-stem test at the 12-36 Windfall well flowed wet gas at a maximum rate of more than 9,600 M.c.f. daily and gave a pipe recovery of 180 ft. of condensate.

Considerable attention has been devoted to this interesting wildcat venture on LSD 12, 36-59-15w5, located 110 miles west-northwest of Edmonton and 70 miles southeast of the Sturgeon Lake oil producing area.

The well is operated by Canadian Fina in a joint exploration project with the Stanolind Oil & Gas Co. and Hudson's Bay Oil & Gas Co., Ltd. The trio holds a spread of over 1,000,000 acres of reservation rights in this general Whitecourt area.

An additional 25 ft. were tested below 28,500 ft. and crew is now coring ahead. Now, 151 ft. of D3 reef have been cored and tested below the contact of that reef at 8,374 ft.

SASKATCHEWAN

Light Gravity Discovery Reported Near Loverna

A very promising discovery of light-gravity crude oil has been recorded in the Viking sand near Loverna, Saskatchewan. The wildcat discovery was made by the team of Phillips Petroleum Co. of Oklahoma and Husky Oil & Refining, Ltd., at their 1 Loverna.

The well, Phillips-Husky 1 Loverna LSD 6, 3-32-28w3, is located 11 miles southeast of the Alberta-Saskatchewan border town of Compeer. It is 19 miles north-northwest of the Smiley-Dewar Viking oilfield.

During a pair of drill-stem tests in the Viking horizon the well showed small natural gas blows and yielded large pipe recoveries of clean 30°-gravity crude oil. Crew has reached total depth of 2,350 ft. and is currently running string of production casing.

Two tests were run in the interval of 2,308 to 2,325 ft. with the best pipe recovery being 2,100 ft. of clean oil. Maximum gas flow was measured at 100,000 cu. ft. daily during the first test but decreased to 25,000 cu. ft. daily by the end of the test.

MANITOBA

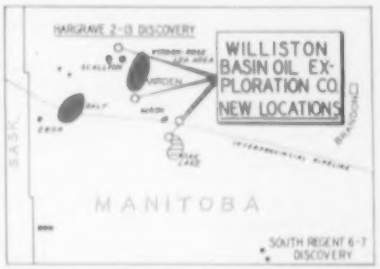
Southwest Manitoba Area Records Two New Strikes

Dome Exploration, Ltd., has opened a new Mississippian oil field in southwestern Manitoba.

Dome-Naco 1-34 South Regent, 3½ miles northwest of the South Regent discovery well, and 9 miles northwest of Whitewater field, recovered 155 ft. of oil on one test, 420 ft. on another. This new prospect is 2 miles southwest of Regent railpoint.

The 2-13 Hargrave well, LSD 2, 13-11-27w1, 1½ miles east of Hargrave town and 6 miles northwest of Virden town, recovered 400 ft. of mud-cut oil.

New locations in area . . . Four wildcats were announced last week for Manitoba. Williston Basin Oil Exploration Co. together with McCarty and Coleman, will drill one wildcat 3 miles northwest of Scallion pool; one 2 miles south of Virden pool; 2 miles east of the Maon field, and one 2½ miles southeast of Maon field.



Southwestern Manitoba has two new Mississippian oil discoveries, one at South Regent and the other at Hargrave.

This group has bought three drilling rigs for use in Canada this year. They formed a drilling company known as Moore Drilling Co., Ltd., in Alberta. Williston is active in Oklahoma and has uranium interests in the Rocky Mountains.

GULF COAST

TEXAS GULF COAST

Oil Production Uncovered In New Beech Creek Area

Sinclair Oil & Gas Co.'s new discovery well in the Beech Creek area, of Hardin County, produced at the rate of 105 bbl. of 36.9°-gravity net oil per day through 5/32-in. choke during potential test. Water flow was at the rate of 61 bbl. per day. Flowing pressure was 700 psi. on the tubing. Gas-oil ratio measured 997 cu. ft. per barrel.

The well, 7 Sternenberg & Co., was drilled to 7,600 ft. but is completed with perforations at 6,012-16 ft. Location is a mile east of North Beech field, a mile west of Fortenberry field, and 1¼ miles north of Beech Creek field. The area is 11 miles north of Silsbee.

Sinclair also has a new discovery in another Hardin County field, South Hampton, 5 miles northwest of Silsbee, and about 6 miles southwest of the Beech Creek area. There, its 19 South Hampton Unit, found production from the G-3 Yegua sand, perforated at 7,916-22 ft. It is estimated good for 25,700,000 cu. ft. of gas daily, open flow. Condensate recovery is in the ratio of 1 bbl. to 29,400 cu. ft. of gas. Gravity of the fluid is 63.5°.

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Second Well Confirms Discovery at Springer

Sinclair Oil & Gas Co.'s gas-condensate discovery in the Springer area, 6 miles southwest of Conroe, in Montgomery County, has been confirmed in the company's second well.

The new well, 2 A. & M. College, is 4,662 ft. northeast of the first well, 1 A. & M. College. Its open-flow potential is calculated at 4,300,000 cu. ft. of gas per day, with gas-condensate ratio of 122,000 cu. ft. per barrel. Fluid gravity is 55.6°. Discovery well was rated at 240,000,000 cu. ft. of gas per day.

Production is from Cockfield sand, the new well being perforated at 5,450-54 ft., and the first well at 5,454-60 ft. Discovery well was completed in April.

SOUTHWEST TEXAS

Maverick Gets Deep Test

Projected depth of Humble Oil & Refining Co.'s newly announced wildcat test, located 17 miles northeast of Eagle Pass, in northern Maverick County, is 16,000 ft. The test, 1 Bandera County, will be the deepest ever drilled in the county. Location is in Bandera School Land Survey 231.

Carrizo Opened at Bowman

Completion by Edgar & Slater of a Carrizo-sand producer in the Bowman field, 12 miles east of Pleasanton, in Wilson County, gives this field its second pay zone. Previous production has been from the slightly shallower Queen City sand. The Carrizo discovery well, 2 Hasse, pumped 72 bbl. of 28°-gravity oil per day with pay perforated at 1,065-69 ft.

SOUTH LOUISIANA

Production Indicated at Pointe Au Fer Discovery

Testing continues at Republic Natural Gas Co.'s indicated gas-condensate discovery well in the Pointe Au Fer area, in the coastal marshes of southwestern Terrebonne Parish.

Initial tests were in sand interval at 11,789-99 ft. Flow through 3/16-in. choke was at an estimated rate of 3,000,000 cu. ft. of gas and 25 bbl. of 43.6°-gravity condensate per day, plus 125 bbl. of water. Bottom-hole pressure gaged 5,120 psi., flowing.

The well, 1 Nelson, is on a Texas Co. farmout. C. G. Glasscock and Tidelands Oil Co. have interests in the discovery.

The discovery is south of the original producing area, opened in 1941, where three gas-condensate wells were completed with producing depths ranging from 5,600 to 6,700 ft. There has been no production in the area since 1949.

The area is only a short distance inland from the Gulf of Mexico, near the southeast shore of Atchafalaya Bay.

Arrow points to Republic Natural Gas Co.'s indicated gas-condensate discovery in Pointe Au Fer area, southwestern Terrebonne Parish.

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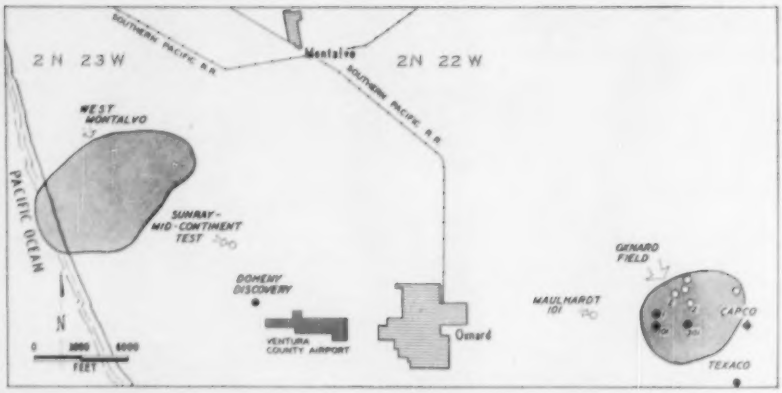

Exploratory eyes in California are currently watching a Sunray Mid-Continent wildcat 1 mile southeast of deep West Montalvo field in Ventura County. The important well is the 1 Ohio-Kraemer-Del Cielo, NE 31-2n-22w.

PACIFIC COAST

CALIFORNIA

Oxnard Test in Spotlight

One of the most closely watched wildcats under way in California was Sunray Mid-Continent Oil Co. 1 Ohio-Kraemer-Del Cielo about 1 mile southeast of the deep West Montalvo field in Ventura County. Its completion will do much to show whether a recent discovery ¾-mile further southeast is an extension to the field or if it is a separate oil accumulation.

The test was halted at 15,450 ft. The operator was preparing to run liner below 7-in. casing set at 14,010 ft. Tests have indicated the wildcat, located in NE 31-2n-22w, may make a commercial well in the deep Sespe sands.

It reportedly was running lower than E. L. Dohney and Richfield Oil Corp.'s recent discovery 1 mile northwest. Their 1 Laubacher last month flowed 227 bbl. daily through a 7/64-in. choke, producing from Sespe sands at 11,126-34 ft. Richfield recently acquired leases totalling about 2,000 acres within city limits of Oxnard, 1½ miles east of this discovery.

Testing Under Way at Deepest Fresno Wildcat

Standard Oil Co. of California as operator for the Kettleman North Dome Unit was testing the deepest well ever drilled in that Fresno County field.

The well 423 34-J was bottomed at 15,693 ft. after setting 5-in. casing at 14,520 ft. Three and one-half-inch liner was run to 15,691 ft. in preparation to testing deep shows.

Deep Oil Find In Prospect For Wheeler Ridge Area

Richfield Oil Corp. may have uncovered another deep pool in southeast San Joaquin Valley. The prospect, 84-31 K.C.L.-D in 31-11n-20w, is about 1½ miles southeast of the 10,000-ft. Eocene pool discovered in old Wheeler Ridge field 3 years ago. Since then the company has drilled more than a dozen deep tests in the surrounding area in search of similar production.

The wildcat was halted at 10,926 ft. to run electrical logs and make further tests after it had showed for a new

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discovery at 10,692-10,850 ft. On a 2-hour formation test it flowed at 1,191 bbl. daily rate during a 1-hour gage. The flow of 38.3°-gravity crude was through a ½-in. choke, and was accompanied by gas at a 2,012 M.c.f. daily rate.

New Fault-Block Pool Added to Beverly Hills

Universal - Consolidated Oil Co. 6 20th Century Fox added a new fault-block pool to the Beverly Hills field.

Allowed to flow for a short period before being shut in pending completion of a pipeline outlet, the well produced at 650 bbl. per day. The pool is at about 7,903 ft., total depth. Zone in which most of the other five wells have been completed was placed behind pipe at drilled depth of 7,000 ft.

Deep Ventura County Wildcat Scheduled

Humble Oil & Refining Co. was preparing to start a deep test near Saticoy in Ventura County.

The wildcat will go down to about 16,000 ft. Spot for the 1 Paul Leavens is 2-19n-2w.

OREGON

Standard Oil Co. of California, which abandoned its first Oregon wildcat as a dry hole just a month ago, announced today that drilling of a second exploratory oil well in Oregon will begin within the next 2 weeks.

Location of the second well will be about 40 miles southeast of Princeville, in Crook County. It will be drilled to test geologic formations in that portion of central Oregon, where Standard holds a number of leases.

Actual drilling operations will be carried on by Thomas Pike Drilling Co., which will move its rig to the new location from the site of the abandoned well near Astoria.

This second well is a continuation of exploratory tests which follow several years of geological survey throughout the Pacific Northwest.

ROCKY MOUNTAIN

NEBRASKA

Two Kimball County Discoveries Completed

Two discoveries west of previous concentrations of production in Kimball County have been completed. Baird-Pfeifer Drilling Co. completed 1 Anderson-Forbes, C NW NW 6-12n-58w for a pump gage of 190 bbl. per day. Production is from "J" sand. The well is 2 miles north of Sisson pool. Empire Drilling Co. has completed 1 Dolcater, SW SW NE 7-16n-56w for a gage of 250 bbl. per day. It is also a "J" sand discovery.

COLORADO

New Denver-Julesburg Permian Discovery Completed

The California Co. has completed 1 Priddy, C NW SW 23-8n-66w, Weld County. Production on pump at completion was 317 bbl. of oil per day. Recovery is from the interval 9,201-10 ft. in Lyons. The well is the second commercial discovery in pre-Cretaceous formations in the Denver-Julesburg basin. It is 4 miles northeast of Black Hollow field, the only pre-Cretaceous pool now producing in the basin. A considerable section of Lyons sand, apparently productive was cored below the perforated interval, with production attempted only from the 9 ft. section. A confirmation has been staked at 2 Priddy, C NW NW 23-8n-66w, and the operator is also drilling at a new wildcat in the general area, 1 Brown, C SE NE 30-8n-66w, a mile north of

Many drillers are saving time by permanently attaching Simplex Screw Jacks to the underside of their rig floor. When the rig is to be moved, turnbuckle bracing is unfastened and jack is swung up, out of way. At new location, jack is swung down, turnbuckles attached and jack is ready to level rig. Jack can't get lost, is always available for use.

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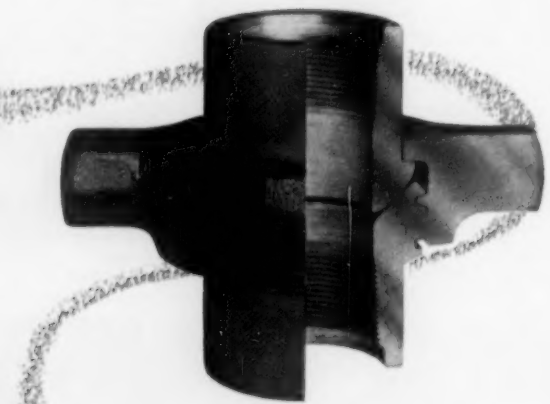

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Black Hollow, and west of the new discovery.

MONTANA

Casing Will be Recemented At Pondera County Well

Casing will be recemented at Western Oils Pondera County discovery, the 2 Bills in SW SE NW 31-28n-6w.

The well recovered gas at the esti-

Western Oils recovered oil and gas at 2 Bills in the Pondera area, Pondera County. The wildcat appears to be a Sunburst sand discovery on the western flank of the Sweetgrass arch.

mated rate of 3,000-5,000 M.c.f. daily with some oil reported. It is thought the gas is from a gas cap through a channel behind the casing. Production at this indicated discovery on the west side of the Sweetgrass arch is from Sunburst sand, topped at 2,814 ft.

WYOMING

First Muddy Production In Line at Manderson

The first Muddy production for the Manderson area of Big Horn County seems assured as a result of tests of a workover well, Mobil Producing Co. F-14-12-G, C SW SW 12-50n-93w.

The well reported a gas flow at the rate of 10,000 M.c.f. per day and a flow of 14 bbl. of oil in 1 hour, 54° gravity. Perforations were at 6,019-57 ft. The nearest similar Muddy production is 6 miles southeast at L. J. Peterson 5 Wycol-Government in C SE NE 12-49n-92w. That new-pay discovery flowed 1,760 bbl. of oil daily on test of the Muddy from perforations at 3,370-3,410 ft.

Tensleep Oil Recovered At South Frisby Wildcat

Tensleep oil has been recovered at a wildcat in the South Frisby area of

Washakie County. Mobil Producing Co. 34-X-24-G, NW SE SW 24-47n-92w, recovered 100 ft. of black oil on a test at 10,948-11,023 ft. in the Tensleep plus 130 ft. of oil-cut mud.

This is an old well worked over and deepened. Old total depth in the Phosphoria was 10,665 ft. The well is located 4 miles east of Worland and 7 miles southeast of the Worland field area.

ARIZONA

Humble Oil & Refining Co.'s Black Mesa basin wildcat, the 1 Navajo Tribal in the W½ NE SE 4-41n-28e, Apache County, is drilling below 4,182 ft. in the Pennsylvanian. This test, which is in the extreme northeastern corner of Arizona, topped the Hermosa at 3,830 ft. No tests have been reported.

UTAH

Wildcat Staked Near Monticello Prospect

The Monticello area of San Juan County in southeastern Utah is in line for another test. White Canyon Mining Co. 3 Sitton, C SW 21-33s-25e, is near the indicated gas discovery in SE NE 20-33s-25e. The same operator is moving in cable tools at the gas strike. The 2 Sitton tested 2,000 M.c.f. of gas per day on a drill-stem test at 5,174-5,202 ft. Total depth is 5,841 ft. No tops are available at this time.

Cortez Oil Co. moved Denver-Julesburg production to its southwesternmost point at 2 Flader with recovery of 2,900 ft. of oil on test of the "D" sand.

Unit approved . . . The U.S.G.S. approved the Coal Bed Canyon Unit in San Juan County. Gulf Oil Corp. is drilling below 5,000 ft. at 1 Unit in C SE SE 15-35s-25e. Last top reported was 4,515 ft., Hermosa.

Successful Wildcats

MANITOBA

Dome Naco 2-13 Hargrave, LSD 2, 13-11-27w1. Lodgepole oil discovery. TD 2,180 ft.

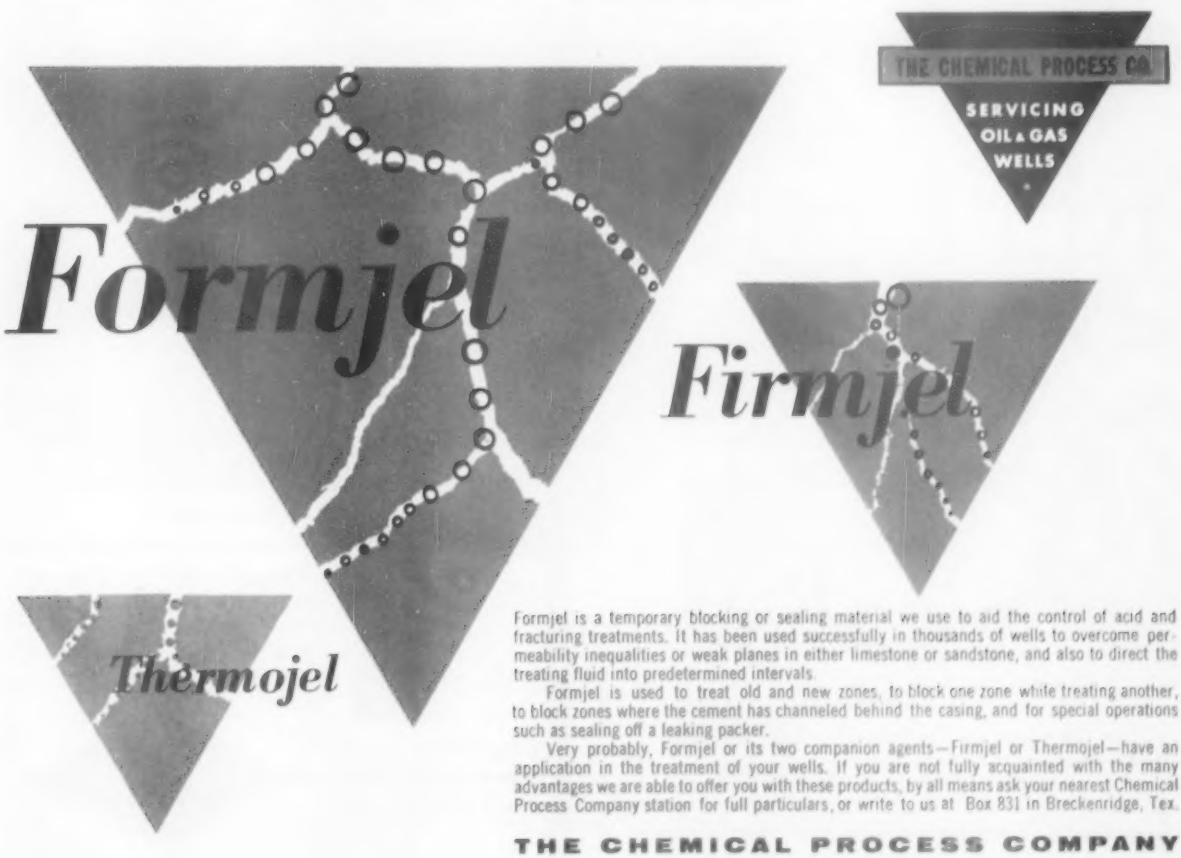
1-34 South Regent, LSD 1, 34-4-22w1. Oil discovery. TD 2,513 ft.

CALIFORNIA

Colusa County: Honolulu Oil Corp. 1 Honolulu-Humble-Tuttle Unit, NE NW 12-17n-2w, IPF 2,030 M.c.f. daily, 20/64-in. choke, 991 psi. tubing pressure, perfs. 2,380-95 ft., TD 3,700 ft. (New gas field 4 miles south of Princeton field.)

Fresno County: Federal Oil Co. 24 Noble, SW NW 10-15s-17e, IPF 150 BOPD, 30°-gravity 10/64-in. choke, Eocene sand at 6,230 ft., TD 6,400 ft. (Fault block discovery in Raisin City field.)

Ventura County: E. L. Doheny, Operator 1 Richfield-Laubacher, 198 BOPD, 29° gravity, 7/64-in. choke, 74 M.c.f. gas, perfs. 11,106-34 ft., TD 14,001 ft. (New pool discovery in Sespe sand at West Montalvo field.)



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COLORADO

Logan County: Herndon Drilling Co. 1 Sprague, C SW SW 24-11n-55w. IP 1,600 M.c.f. of gas per day, "J" sand discovery, new field. TD 5,530 ft. Skull Creek.

KANSAS

Trego County: Atlantic Refining Co. 1 Kutina, SW NW SW 20-15s-21w. IPP 180 BOPD, Conglomerate 4,220-25 ft., 41.2°. TD 4,426 ft. (Opens Kutina pool).

SOUTH LOUISIANA

Cameron Parish: Forest Oil Corp. 1 Ehni & Darling, 13-15s-6w. Shut-in gas-condensate well, no gage, perforations 11,716-30 ft. TD 12,753 ft. (New field—2 miles northwest of Crab Lake field.)

Jefferson Davis Parish: Benedum-Trees Oil Co. 1 Muma Mallet heirs et al, 27-10s-4w. Shut-in gas-condensate well, IP 5,000 M.c.f. daily (estimated), spray condensate, 48°, perforations 11,148-52 ft. and 11,158-67 ft. TD 13,407 ft. (New field, 1¾ miles northwest of Lake Arthur field.)

Plaquemines Parish: Shelf Oil Co. 1 State Lease 2666, Block 30, South Pass area, Gulf of Mexico. IP 405 M.c.f. daily, ¼-in., dry gas, perforations 9,528-46 ft. TD 13,468 ft. (New field—offshore.)

St. Landry Parish: Columbian Carbon Co. 1 Horaist, 87-7s-4e. IP (estimated) 3,000 M.c.f. daily and 240 BCPD, adjustable choke, 52°, perforations 10,374-78 ft. TD 12,260 ft. (New field.)

Terrebonne Parish: Union Producing Co. 1 Matherne, 41-17s-18e. IP 6,369 M.c.f. daily, ¼-in., gas, perforations 11,124-27 ft. TD 13,269 ft. (New pay and extension, Bourg field.)

NORTH DAKOTA

Bottineau County, North Souris: Lion Oil Co. 1 Skarphol, C SE NW 33-164n-77w. IP 100 BOPD, Mission Canyon discovery, new field. TD 3,018 ft. Mission Canyon.

OKLAHOMA

Cimarron County: Shell Oil Co. 1 Phillips "B," NW NW SE 8-4n-8eCM. IP 30,000 M.c.f. of gas per day, open flow, 4,753 ft. TD 4,865 ft. (Gas discovery).

Kay County: Sam King 1 Harmon, ¾ mile west of Southwest Ponca City field, NW NE NW 8-25n-1e. IPP 23 BOPD, Red Fork sand 4,084-100 ft., 39°. TD 4,351 ft. (Oil discovery).

Osage County: Wayne R. Abbot-Amerada Petroleum Corp. 1 Osage, NW NE NE 9-22n-7e. IPP 58 BOPD, Arbuckle 2,952-72 ft., 30°. TD 2,972 ft. (Oil discovery).

TEXAS GULF COAST

Galveston County: Pure Oil Co. 2-A Ocs 092, Block 190, Galveston area, Gulf of Mexico. IP 19,200 M.c.f. daily, open-flow potential, GLR 32.3 M.c.f. per barrel, 55°, perforations 6,697½-6,705½ ft. TD 10,653 ft. (New pay in GAB 189 field—offshore.)

Hardin County: Sinclair Oil & Gas Co. 19 South Hampton Unit, H. Binns Sur., A-6. IP 27,700 M.c.f. daily, open-flow potential GLR 29.4 M.c.f. per barrel, 63.5°, perforations 7,916-22 ft. (G-3 Yegua). TD 8,300 ft. (New pay in South Hampton field.)

San Patricio County: Pontiac Refining Co. 1 Chopelas, George H. Paul Subd., Welder Ranch. IP 17,000 M.c.f. daily, open-flow potential, GLR 116 M.c.f. per barrel, 58.1°, perforations 5,611-16 ft. TD 5,805 ft. (New field.)

Signet Drilling 1 Keeton, George H. Paul Subd., Welder Ranch. IP 172.8 BOPD, 5/32-in., 32.9°, GOR 210 cu. ft. per barrel, perforations 5,550-58 ft. TD 5,782 ft. (New field.)

SOUTHWEST TEXAS

Atascosa County: Drilling & Exploration, Inc., 1 Dalkowlitz et al, M. Biehl Sur. 1503, A-89. IP 37.41 BOPD, ¼-in., 38.5°, Navarro 4,288-96 ft. (perforations). TD 4,350 ft. (New pay in North Crown field.)

Texas Eastern Producing Co. 1 Finch et al, John M. Finch Sur. 78, A-1273. IP 99.32 BOPD, ¼-in., 37.9°, Navarro 5,020-35 ft. (perforations). TD 5,080 ft. (New field.)

Duval County: Sun Oil Co. 1-A Garcia, San Andres Grant, A-657. IP 31,000 M.c.f. daily, open-flow potential, 1.2 BC per M.M.c.f., perforations 4,293-98 ft. TD 4,304 ft. (New field.)

Jim Wells County: L. M. Lockhart 1 Galindo, La Tinaja de Lara Grant, A-36. IP 110 BOPD, 11/64-in., 44°, perforations 3,956-60 ft. TD 5,120 ft. (New field.)

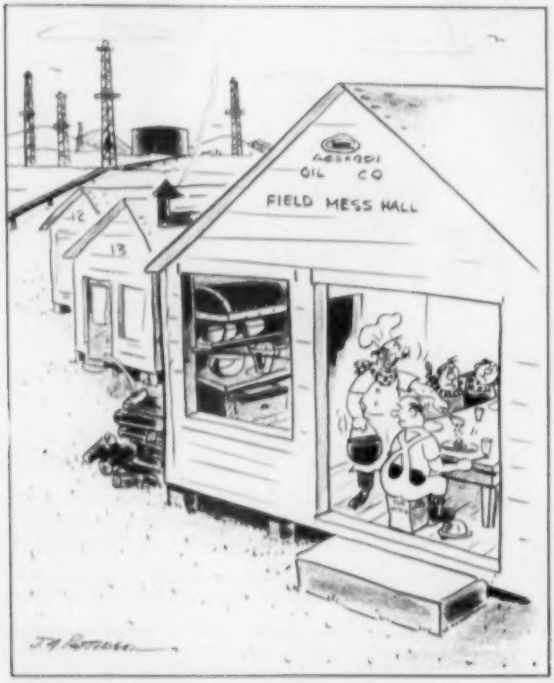
Medina County: Lukin Gilliland and Robert Buckley 1 Adair, San Antonio Trust Co. Subd., Block 9. IPP 5 BOPD, open hole 466-70 ft. TD 470 ft. (New field.)

Webb County: Parr and Delaney Oil Co. 1-B George Parr, San Casimiro Grant. IPP 9.93 BOPD (net), 28 per cent water, 20.7°, open hole 829-42 ft. TD 842 ft. (New field.)

EAST TEXAS

Gregg County: F. R. Jackson and John C. Robbins, Jr. 1 Louie Bryant, 3½ miles

THE OIL AND GAS JOURNAL



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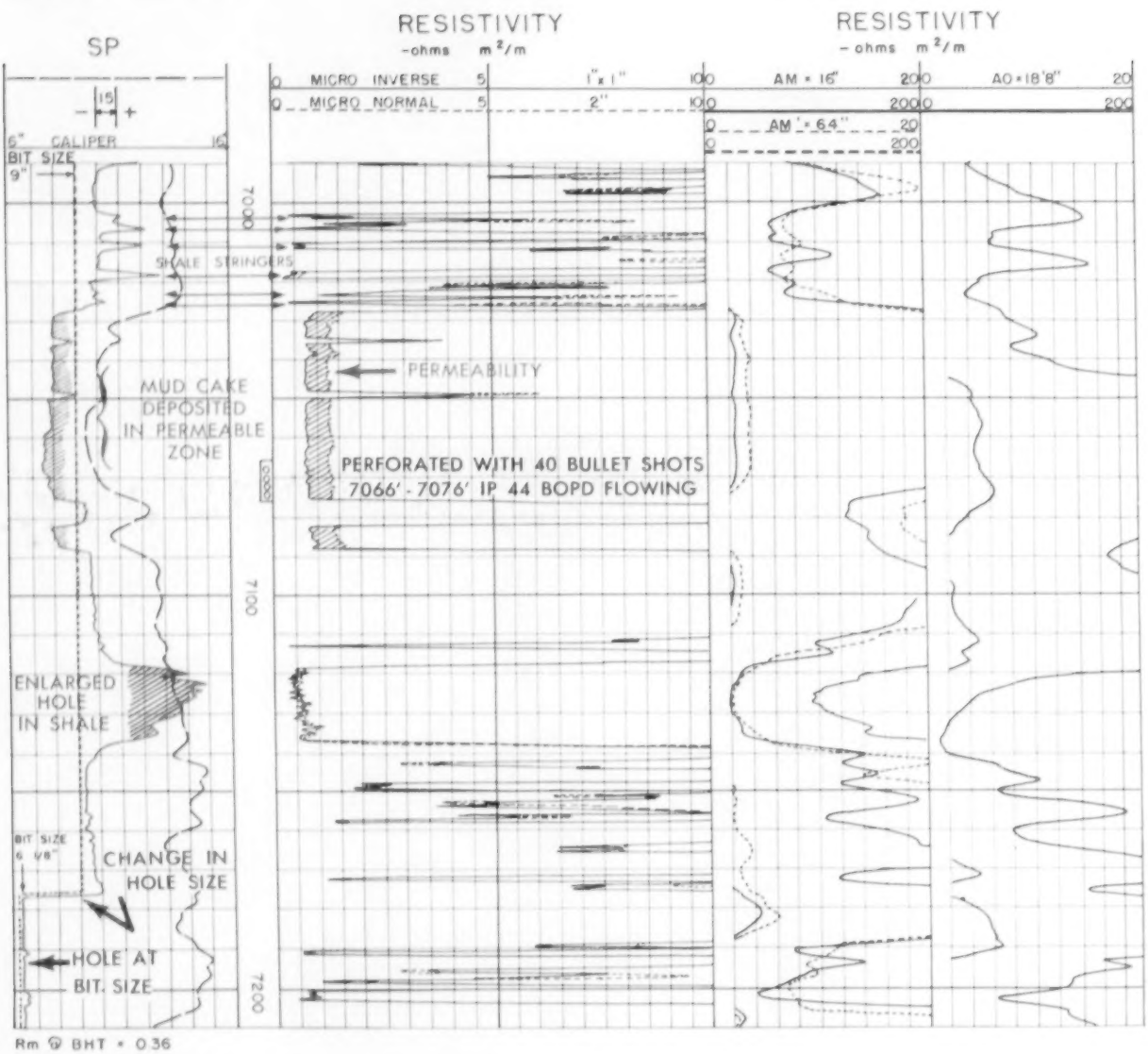

The example above is of an East Texas well which was completed in the upper Rodessa of lower Cretaceous Age. The well was perforated from 7066'-7076' with 40 bullet shots. Initial production was 44 BOPD. Average porosity from core analysis in the section 7066'-7076' is 18%. Permeability for the same zone averaged 14 md. and the water saturation averaged 24%.

The example illustrates the ability of the Microlog to locate porous permeable zones. The movement of the pads against the borehole face also gives a MicroCaliper that confirms mud cake deposition in permeable zones and indicates caving sections such as may be present in shales and other hole conditions important to the completion of the well.

THE EYES OF THE OIL INDUSTRY **SCHLUMBERGER**

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west of Easton in Francisco Castro Sur. IPF 176 BOPD, 12/64-in. choke, 41°, lower Pettit 7,107-13 ft. top pay 7,108 ft. TD 7,190 ft. (Oil extension).

Panola County: Rudco Oil & Gas Co. 2-A Rudman-Genecov, 15 miles northeast of Tatum in W. M. Spencer Sur., ½ mile southeast of production at South Hallsville. IP 10,400 M.c.f. of gas per day and some condensate, Page zone 6,567-79 ft. TD 6,636 ft. (Gas extension).

WEST TEXAS

Ector County: Texas Pacific Coal & Oil Co. and Eastland Oil Co. 1 J. Lee Johnson, Jr. Farm "B" AC/1, Sec. 37, Blk. 44, T-1-S, T&P Sur., 9 miles northwest of Odessa. IP F 426 BOPD, 20/64-in. choke, 38.6°, perfs. Penn. 8,684-88 ft. TD 12,838 ft. (Pennsylvanian oil discovery).

Pecos County: Liedtke & Liedtke et al 1 Penn-Shearer, Sec. 43, Blk. 10, H&GN Sur., 7 miles southeast of Imperial. IPF 63.2 BOPD, 8/64-in. choke, 36°, Perfs. top 1,835 ft. TD 1,883 ft. (Suggested name of new pool is Pecos Shearer).

WEST TEXAS BORDER COUNTIES

Nolan County: C. T. McLaughlin 1 E. A. Ater, 67-23, T&P, 5 miles southwest of Roscoe. IPF 308 BOPD, based on 193 BO in 15 hours, 43.5°, Strawn 6,741-61 ft. TD 7,325 ft. (Oil discovery. Opens Roscoe Strawn field).

Runnels County: Warren Sorrels 1 M. M. Barnhill, Sec. 23, Thomas Fowler Sur. No. 440. IPF 116 BOPD, 12/64-in. choke, 46.6°. Perfs. 4,547-53 ft. TD 4,780 ft. (Oil well).

WEST CENTRAL TEXAS

Stephens County: Leo Vesenmier, Jr. 1 Minnie Jester Liles, 14 miles northwest of Breckenridge in T. V. Baker Sur. IPF 174 BOPD, ¼-in. choke, 45°, Caddo lime 4,476-82 ft. TD 4,498 ft. (Oil discovery).

Taylor County: V. C. Perini, Jr. et al 1 Elmer Griffith, 3 miles east of Abilene, Sec. 31, BAL Sur. IPF 186 BOPD, ¼-in. choke, 40°, Palo Pinto reef 3,280-90 ft. TD 3,303 ft. (Oil discovery).

A. B. See Drilling Co. et al 1 E. L. Hamilton, 4 miles east of Tye, Sec. 33, Blk. 16, T&P Sur. IPP 51.45 BOPD, King sand 2,283-91 ft., 42°, TD 3,757 ft. (Oil discovery).

Throckmorton County: G. E. Kadane & Sons 3-A Condron, 7 miles south of Throckmorton in Sec. 1630, TE&L Sur., 5 miles from production. IPP 95.69 BOPD, open hole in Palo Pinto lime, top pay 2,626 ft., 40.5°, TD 2,633 ft. (Oil discovery). Suggested field name is Condron Palo Pinto field.

NORTH TEXAS

Archer County: W. B. Hamilton 1-D Sheckells, 5½ miles southwest of Archer City in C. A. Scheckells Sur. A-1235. IPF 120.52 BO 6 hours, 13/64-in. choke, 43°, open hole in Miss. lime, top pay 5,200 ft. TD 5,221 ft. (Oil discovery).

Clay County: J. C. Man, Jr., 1 C. W. Scaling, 5 miles north of Bellevue in Blk. 5, T&NO Sur. IPF 41.75 BOPD, 12/64-in. choke, 43°, perfs. in congl. 6,410-428 ft. GOR 600:1. TD 7,280 ft. (Oil discovery).

Sewell Investment Co. 1 T. T. Fenoglio, 3 miles northwest of Ringgold in J. Barlow Sur. A-15, ½ mile southwest of production. IPP 127.16 BOPD, 41°, open hole congl. top pay 5,921 ft. TD 5,936 ft. (Oil extension at Staley).

Foard County: Panhandle Oil Corp. 1 Effie Bell, Luce Sur., 3 miles southeast of Crowell, IPF 440.84 BOPD, 24/64-in. choke, 35°, perfs. congl. 5,410-18 ft. GOR 750:1. TD 5,900 ft. (Oil discovery).

Grayson County: Nortex Oil & Gas Corp. 1 O. E. Dawkins, 2½ miles northeast of Collinsville in Meredith Sur. A-844. IPP 184 BOPD, 27°, Strawn 4,010-30 ft. TD 4,713 ft. (Oil discovery).

Young County: R. H. Busby et al 1 Cuisenbary, ¼ mile northeast of Murray in Blk. 18, Young CSL Sur. A-1285. IPF 156.5 BOPD, 8/64 in. choke, 40° perfs. 3,212-22 ft. TD 3,662 ft. (Oil discovery).

Timberlake & Kelleher 1 Nellie Prideaux, 4½ miles northeast of Farmer in A. McMullen Sur. A-198. IPP 41.40 BOPD, 39°, open hole top pay 744 ft. TD 758 ft. (Oil discovery).

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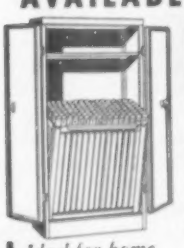

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PERSONALS

Committee Champ

Signal's Andrews serves industry in many spots

PAUL ANDREWS, chief production engineer for Signal Oil & Gas Co., Los Angeles, has added another committee chairmanship to an already impressive list compiled in almost 30 years of service in the oil industry.

At its recent annual election of officers the Conservation Committee of California Oil Producers named him chairman for 1955-56. He previously had served on the committee for 9 years as a district representative and for 1 year as engineering board chairman.

His term will have the added luster of being the first during which the committee will operate as a "legitimate" group. Heretofore its activities have been purely voluntary and without official state sanction. They will continue to be voluntary but now bear the stamp of the California Legislature following passage of an enabling act during the past session.

Native Texan . . . A native of Henrietta, Tex., Andrews attended public schools in Salt Lake City and studied mining engineering at the University of Utah. After trying his hand at silver mining and assaying work, he switched to the petroleum industry in 1926.

His first duties were as a test and natural-gas engineer with Standard Gasoline Corp. at Long Beach. In addition to his work he attended the University of Southern California to study petroleum engineering. In 1928 he left Standard to join Italio Petroleum Co. Then in 1930 he joined Signal Oil & Gas Co. as production engineer in Los Angeles.

With Signal he helped pioneer gas-lift techniques, using residue gas from the Signal Hill plant to increase that field's oil production. In 1935 he was transferred to the Elwood field as a production engineer.

At Elwood his work in the field of reservoir engineering led to Signal establishing a production engineering department in 1938. Except for a brief tour at Long Beach when Wilmington field was booming, Andrews has been in the Los Angeles main office as head of this department.

Other offices . . . The regard in which he is held by the petroleum engineering profession is illustrated by the fact that in 1949 he was chairman of the Pacific Petroleum Section of the American Institute of Mining and Metallurgical Engineers.

At the same time he was national chairman of the American Petroleum Institute's topical committee on production practices. He was vice chairman of the national A.I.M.E. petroleum branch in 1950 and in 1951 headed the West Coast chapter of the A.P.I. division of production.

He takes a great personal interest in student activities. As Pacific Coast A.I.M.E. chairman he initiated the practice of an annual West Coast meeting of student chapters. Last year he was chairman of the national group's student activities committee. He is an honorary member of Pi Epsilon Tau, the national petroleum engineering fraternity.

Current association activities of Andrews include being vice chairman of the A.P.I. central committee on district activities and a member of the division of production general committee. He also continues as historian for the Petroleum Production Pioneers.

Other than serving the petroleum industry, his hobbies include photography and fishing. Formerly an ardent deep-sea fisherman, in recent years he has preferred frequent trips to the mountains in search of trout.

He is married to the former Mina Olson, a native of Kansas. They and their two teen-age daughters, Paula and Patricia, live in San Marino.

R. M. Dost has resigned as a field engineer at Greggton, Tex., for Stanolind Oil & Gas Co., to join Kingwood Oil Co. at Mount Vernon, Ill., as a petroleum engineer.

Louis Newitt, San Antonio, has resigned as a geologist for Continental Oil Co. to open consulting offices in San Antonio.

Luther W. Randerson, senior petroleum engineer for Magnolia Petroleum Co. at its West Texas division headquarters in Midland, Tex., has been promoted to section chief in charge of drilling - engineering and drilling - mud control at company headquarters in Dallas. **William N. Smith,** petroleum engineer assistant at Kermit, Tex., has been transferred to Natchez, Miss.

J. R. (Ray) Vandever has been named manager of the newly formed property acquisition department of Sunray Mid-Continent Oil Co. Vandever joined the Sunray organization in 1930 and served as division superintendent of the company's North and West Texas districts before being transferred to Tulsa in 1948.

William H. Tietz has been elected secretary and treasurer of Sunset Oil Co., Los Angeles. Tietz, former assistant secretary-treasurer, has been associated with Sunset and Eagle Oil & Refining Co. for 20 years.

Marion W. Boyer, former executive vice president Esso Standard Oil Co. and now a director of Standard Oil Co. (N. J.), has been elected to the board of directors of the Commerce and Industry Association of New York, Inc.

Lowell N. Applegate has been named to the newly created post of assistant vice president in charge of production for Falcon Seaboard Drilling Co., Tulsa. Applegate was formerly with Phillips Petroleum Co. for 7 years and had served as assistant reservoir engineer for the Gulf Coast area since 1952.

W. B. Smith has resigned as division manager for Husky Oil Co. at Midland, Tex., to join J. E. Jones Drilling Co., Midland. The Jones firm is engaged in exploration and production as well as contract drilling. Smith had been Husky division manager at Midland 5 years. Prior to that, he spent 3 years with Husky at its Cody, Wyo., headquarters. **W. C. Kimball** has resigned as district manager for Coronet Oil Co. at Midland to join Husky as division manager, replacing Smith.

PERSONALS

Raymond W. Snyder has been appointed divisional geologist for the central division of Tide Water Associated Oil Co. in Tulsa.

Charles J. DeLancey, geologist with Humble Oil & Refining Co., has been transferred from Chico, Calif., to Los Angeles.

Dr. M. Dean Kleinkopf, who recently was graduated from Columbia University with a Ph.D. in geology, has joined Standard Oil Co. of California at Oildale, Calif.

J. R. French, former party chief for Gulf Oil Corp at Odessa, Tex., has been promoted to zone geophysicist at Midland, Tex. **J. A. Sheldon,** former party chief with the company at Pampa, Tex., has been promoted to zone geophysicist at Roswell, N. M.

Harry A. Trueblood, Jr., Denver; **John E. Price,** Fort Meyer, Fla.; **Theodor F. Rittenberg,** Denver; **Saul A. Levine,** New York City; and **Harley B. Graff,** Denver, have been elected directors of Rimrock Drilling Co., Inc., of Denver. Trueblood also serves as president of the firm.

Frederick William Dittus, chief engineer of California Texas Oil Co., Ltd., since 1944, has been appointed assistant

F. W. DITTUS

R. R. TILLOTSON

vice president. Dittus, who started his petroleum career with Standard Oil Co. of California in 1916, is in charge of design and construction of refineries, pipelines, and other major facilities for the Caltex group. **Robert R. Tillotson,** a veteran of 35 years with Caltex and Standard of California, has been named managing director of Caltex Oil Refining (India), Ltd. He will be in charge of the Caltex refinery now under construction at Visakhapatnam, India.

Folkert Brons, Shell Oil Co., formerly in Houston, has been transferred to Los Angeles as area reservoir engineer. **J. E. Dozier, Jr.,** development engineer, has been moved from Ventura, Calif., to Long Beach. Additional changes in Shell's Los Angeles area production division include **W. J. Bransford,** from Salt Lake City to Long Beach, and **R. B. Gaul,** from Los Angeles to Bakersfield, Calif.

Eugene N. Ply has joined the staff of the Whiting Research Laboratories of Standard Oil Co. (N. J.). Ply was with Esso Standard Oil Co. before joining Standard of Indiana.

L. H. Foster, district superintendent for Anderson-Prichard Oil Corp. at Hobbs, N. M., will be transferred to Midland, Tex., in the same capacity when the company consolidates its Hobbs and Midland offices at Midland August 12. Also being transferred to Midland will be **Carol M. Goulson,** district engineer, and **Don Tankersley** and **John D. Dakin,** petroleum engineers.

Allen B. Hiatt has been named assistant to the president of Pacific Northwest Pipeline Corp., Houston. He had been serving with Phillips Petroleum Co. A graduate chemical engineer, Hiatt has had more than 25 years of experience in the natural-gasoline and natural-gas business.

J. Pelham Johnston has been named assistant secretary and United States operations manager for Williston Oil & Gas Co., Casper, Wyo. He succeeds **Robert W. Campbell,** who has been transferred to Calgary to supervise pipeline construction for Oilwell Operators, Ltd.

DEATHS

Harry B. Britton, 59, executive vice president of Trans-Arabian Pipe Line Co. and a widely known pipeline authority, died July 30 at his home in Stamford, Conn. Britton was a graduate of the University of Illinois in 1924. His first job in the oil industry was with Shell Oil Co. as a refinery engineer. He stayed with Shell until 1942, when he became chief engineer of Plantation Pipe Line Co. In 1947, Britton joined Standard Oil Co. (N. J.) and in 1951 went to Trans-Arabian. During World War II he was an oil consultant for the Government.

Donald L. Harper, 77, retired director of Standard Oil Co. (N. J.), died August 1 at his home in Fort Lauderdale, Fla. Harper started his Jersey Standard career in 1899 as a stenographer. In 1928, he was elected president of Esso Export Corp., an overseas marketing affiliate of Jersey Standard. He was named to the parent company's board of directors in 1935.

Rex P. Grant, 50, petroleum geologist in the geological survey division of the Michigan Department of Conservation for the past 21 years, died recently at his home.

Tom Craig, 52, head of Phillips Petroleum Co.'s Panhandle natural-gas division, died recently in his Amarillo, Tex., office of a cerebral hemorrhage.

Tom V. Marks, 46, vice president and field supervisor in New Mexico for Neville G. Penrose, Inc., Fort Worth independent operator, died July 31 in an automobile accident 10 miles east of Atoka, Okla.

Edgar M. Clark, 88, former vice president of Standard Oil Co. (N. J.) and coinventor of the first successful oil-cracking process, died recently in Phoenix, Ariz. Clark aided the late Dr. William M. Burton in invention of the Burton pressure still. The cracking process ended a threatened shortage of gasoline and revolutionized refining. Clark was also president of what is now Esso Research & Engineering Co., Esso Shipping Co., and was one of the founders of Ethyl Corp.

James E. Hallowell, 34, member of the geological and engineering firm of Dean & Hallowell, died recently in his sleep in Carmi, Ill. Hallowell, a graduate of the University of Illinois, was widely known throughout the Tri-State area.

John T. (Sy) Wicker, 70, veteran California oil man who discovered the Poso Creek oil field in the late 1920's, died recently at his home in Bakersfield, Calif., after a short illness. Wicker later discovered an oil sand which was named after him.

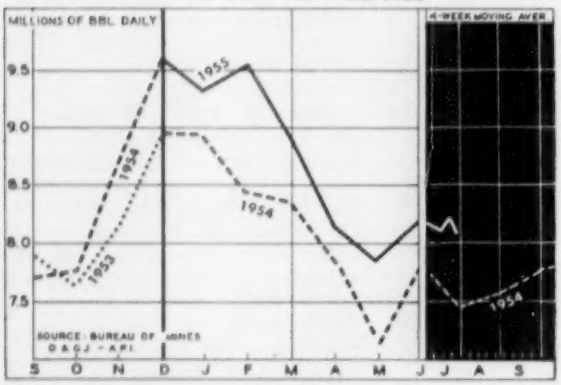
C. R. Houssiere, 62, pioneer oil developer in the Jennings, La., area, died recently in a New Orleans hospital after an illness of several years. The first oil well brought in in Louisiana was on land owned by Houssiere's family.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,630,000	DOWN	17,350	UP	414,880
Crude stocks	270,027,000	UP	1,212,000	DOWN	9,858,000
Completions	1,146	DOWN	71	UP	106
Refinery runs	7,577,000	DOWN	43,000	UP	750,000
Gasoline stocks	157,005,000	DOWN	673,000	DOWN	1,397,000
Distillate stocks	115,936,000	UP	3,544,000	UP	15,497,000
Residual stocks	45,457,000	UP	197,000	DOWN	9,194,000
Four-product stocks	350,398,000	UP	3,862,000	UP	5,538,000
Total imports	1,187,300	UP	194,800	UP	321,500

TOTAL DEMAND - ALL OILS



Research Aids in Bringing Better Market Conditions

SOME sales managers plagued with the various types of price cutting may not agree, but there are veteran refiners and jobbers who feel there has been progress in bringing about more stabilized conditions in the marketing of petroleum products.

Credit for the improvement goes to oil-company managements and jobbing organizations which are giving more attention to marketing with the objective of assuring sound merchandizing practices. This includes automotive and other items distributed and sold along with oil products.

As explained by one major company executive, the industry has started to do in marketing what it has always done in exploration, production, refining, and transportation. These divisions, it is pointed out, are held to a strict accounting of how they carry on their operations with the view of ending or avoiding bad practices and expanding those practices which are soundly based.

Research, long considered an essential part of the operations of other divisions, is now bringing constructive changes in marketing. Many of the larger oil companies have marketing research departments and some jobbing organizations have retained consultants in marketing.

The research extends to practically all phases of petroleum marketing. It includes design and operation of bulk and retail stations, credit, financing, transportation costs, employe training, tourist trade, sale of products other than petroleum, and other practical problems in oil marketing. As a result many bad methods of the past have been dropped and sound methods installed.

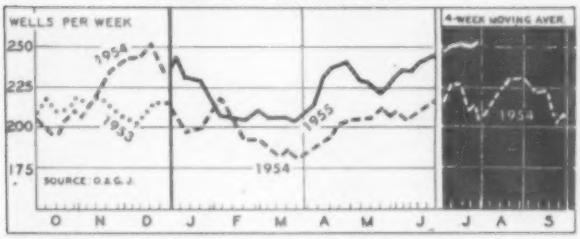
Surveys to determine customers' attitudes have been enlightening. In general they have shown that consumers are more interested in service and quality of products than in prices. Particular attention is also being given on how to reduce the large turnover in independent dealers, a situation which is often associated with undesirable practices in the "cash register" end of the oil business.

Still another phase of research has to do with statistical trends dealing with such subjects as seasonal variations in consumption, long-range demands, storage, and other subjects which are vital in directing operations from month to month. Those in close touch with conditions agree that these activities not only tend to minimize undesirable marketing practices, but they have aided the entire industry by giving all divisions the needed yardsticks for their operations.

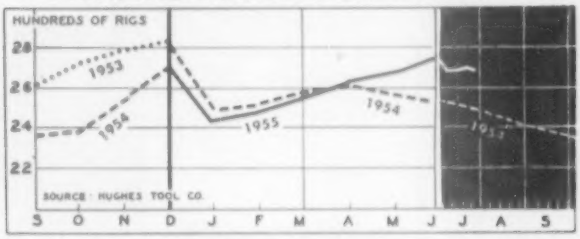
There is now a widening variation in summer and winter consumption of petroleum products. The trend has been to maintain maximum rates in refining and production not justified by changes in actual consumption. This procedure tends to oversupply markets and bring price concessions not justified by over-all conditions.

Marketing departments can now provide their refining departments with accurate projections of changes in demands by totals and by products. The refining departments can in turn pass this information on to production departments as a guide to the required crude-oil supply. The value of this information was apparent in the shift from the maximum winter operations to the reduced supplies required for spring and summer of this year. It is felt by many that this has been an important factor in the current improved marketing conditions over a year ago.

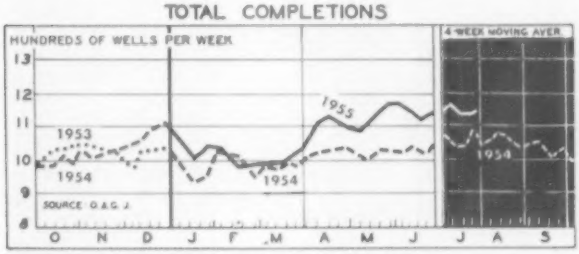
WILDCAT COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



TOTAL COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	8-1-55	Change from 7-25-55	Change from 8-2-54
Gulf Coast	586	1	40
N. and W. Texas-New Mexico	849	3	77
Arkansas-N. Louisiana-E. Texas	165	0	10
Oklahoma	318	—21	8
Kansas-S. Nebraska	172	— 7	15
Illinois-Eastern	144	8	29
Rocky Mountain	304	4	41
Pacific Coast	143	— 1	23
Total United States	2,681	—13	243
Western Canada	218	2	40

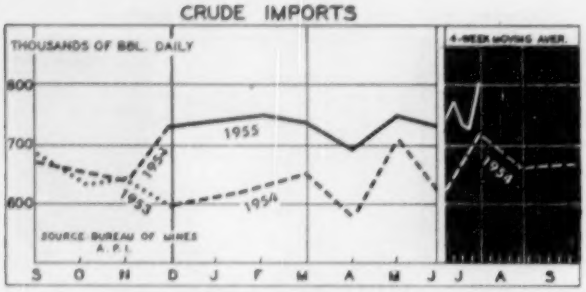
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JULY 30, 1955

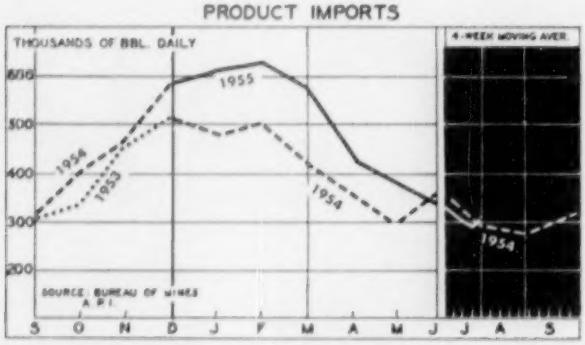
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1955	Cum. 1954	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1955: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	0	0	0	0	0	48	65	0	0	0	0	0	0	0	0	46	46
Arkansas	14	9	0	5	37,647	427	344	0	0	0	2	2	20	0	2	91	113
California	39	28	2	9	191,250	1,458	1,420	2	0	1	6	9	26	0	7	227	260
Colorado	34	7	1	26	179,857	812	764	0	0	1	22	23	26	0	18	419	463
Illinois	118	71	2	45	299,372	2,182	1,615	2	0	1	16	19	39	0	3	304	346
Indiana	22	6	0	16	29,062	433	463	0	0	0	10	10	8	0	0	182	190
Kansas	101	47	7	47	358,645	2,907	2,567	3	0	3	20	26	87	1	25	466	579
Kentucky	27	7	1	19	38,384	755	648	2	0	0	11	13	34	0	7	147	188
Louisiana	78	45	11	22	555,563	2,286	1,927	2	2	4	12	20	70	47	18	241	376
North	37	24	3	10	119,660	1,206	1,024	0	0	0	6	6	13	4	2	98	117
South	41	21	8	12	435,903	1,080	903	2	2	4	6	14	57	43	16	143	259
Michigan	3	1	0	2	10,706	288	319	0	0	0	2	2	6	0	0	109	115
Mississippi	8	3	0	5	58,022	275	224	0	0	0	2	2	12	0	0	94	106
Montana	7	4	0	3	40,740	179	168	0	0	0	3	3	5	0	1	53	59
Nebraska	17	8	0	9	93,599	441	205	1	0	0	7	8	25	0	0	183	208
New Mexico	24	13	9	2	83,245	924	642	0	0	0	2	2	20	1	8	72	101
Northwest	7	0	7	0	25,308	288	223	0	0	0	0	0	2	0	8	24	34
Southeast	17	13	2	2	57,937	636	419	0	0	0	2	2	18	1	0	48	67
North Dakota	4	4	0	0	29,955	134	160	1	0	0	0	1	2	0	0	24	26
Ohio	13	9	1	3	33,673	651	668	0	0	0	0	0	1	0	4	14	19
Oklahoma	175	107	10	*58	566,256	5,045	5,335	3	0	1	13	17	91	8	20	384	503
Pennsylvania-New York	24	6	8	*10	60,434	922	1,388	0	0	0	0	0	0	0	6	7	13
Texas	415	260	13	142	1,783,076	11,615	10,590	22	3	3	83	111	448	64	77	2,412	3,001
Southwest (1 & 4)	54	35	1	18	176,330	1,789	1,478	6	2	0	15	23	63	21	24	456	564
Gulf Coast (2 & 3)	62	28	5	29	370,754	1,477	1,527	0	1	1	19	21	51	34	36	383	494
East (5 & 6)	19	6	4	9	110,313	568	566	1	0	2	6	9	16	4	6	186	212
North Central (7-B & 9)	188	114	0	74	549,016	4,370	3,999	12	0	0	36	48	233	0	7	949	1,189
West (7-C & 8)	70	59	0	11	502,793	2,837	2,475	3	0	0	6	9	82	1	6	420	509
Panhandle (10)	22	18	3	1	73,870	574	545	0	0	0	1	1	3	4	8	18	33
Utah	1	0	0	1	650	45	36	0	0	0	1	1	4	0	3	27	34
West Virginia	3	0	3	0	8,959	344	321	0	0	0	0	0	0	0	8	10	18
Wyoming	19	8	3	8	72,959	456	783	0	0	0	5	5	13	0	5	100	118
Miscellaneous	0	0	0	0	0	19	84	0	0	0	0	0	0	0	1	14	15
Total United States	**1,146**	643	71	432	4,532,054	32,646	30,736	38	5	14	217	**274**	937	121	213	5,626	6,897
Total previous week	1,217	697	98	422	4,744,537			34	3	11	205	253	899	116	199	5,409	6,623
Total July 31, 1954	1,040	566	81	393	4,252,117			23	3	8	175	209	832	88	218	5,076	6,214
Western Canada	77	56	3	18	286,868												

Service wells included: *6.

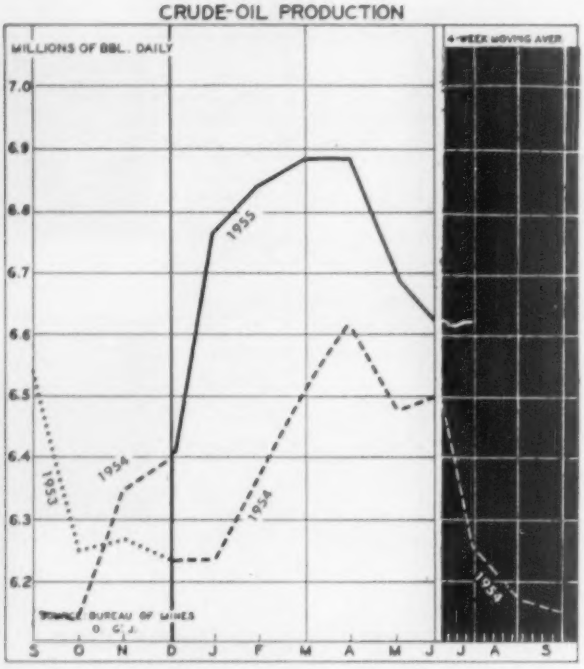
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

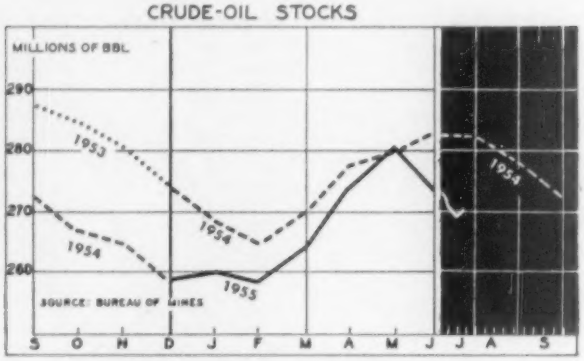


DAILY AVERAGE PRODUCTION FOR WEEK

	July 30 Crude oil	July 30 Lease condensate	July 30 Total	July 23 total
Alabama	3,700		3,700	3,500
Arkansas	73,100	450	73,550	73,800
California	977,200		977,200	977,200
Colorado	148,900		148,900	148,600
Eastern	49,800		49,800	49,800
Florida	1,325		1,325	1,325
Illinois	234,300		234,300	231,200
Indiana	30,900		30,900	30,200
Kansas	326,900		326,900	331,300
Kentucky	42,200		42,200	40,900
Louisiana	662,100	56,900	719,000	719,800
North	115,100	2,900	118,000	118,800
South	547,000	54,000	601,000	601,000
Michigan	31,200		31,200	33,900
Mississippi	96,200	3,925	100,125	100,125
Montana	45,800		45,800	45,600
Nebraska	28,300		28,300	29,900
New Mexico	224,600	3,400	228,100	228,100
North Dakota	33,900		33,900	29,700
Oklahoma	542,100		542,100	562,200
Texas	2,675,700	47,700	2,723,400	2,723,400
Dist. 1	48,000	475	48,475	48,475
Dist. 2	132,700	7,100	139,800	139,800
Dist. 3	418,000	23,000	441,000	441,000
Dist. 4	223,000	5,000	228,000	228,000
Dist. 5	47,200	425	47,625	47,625
Dist. 6	114,500	4,750	119,250	119,250
East Texas field	202,000		202,000	202,000
Dist. 7-B	139,500	50	139,550	139,550
Dist. 7-C	170,000	4,300	174,300	174,300
Dist. 8	900,000	2,000	902,000	902,000
Dist. 9	191,000	450	191,450	191,450
Dist. 10	89,800	150	89,950	89,950
Utah	5,500		5,500	5,000
Wyoming	283,600		283,600	281,400
Others	‡300		‡300	400
Total U. S.	6,517,625	112,375	**6,630,000**	6,647,350
Change from prev. week, down			**17,350**	
Canada	†415,500		†415,500	†402,225
Total U. S. production January 1-July 30			1,416,076,500 bbl.	
Same period last year (crude plus cond.)			*1,355,127,645 bbl.	

*Includes 20, 998,700 bbl. condensate. †Week ended previous Monday. ‡S.D. 100. Nev. 200.

CRUDE-OIL STOCKS



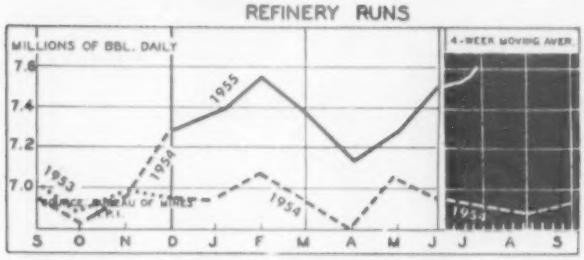
CRUDE-OIL STOCKS BY STATES OF ORIGIN*
(Thousands of barrels)

	July 23, '55	July 16, '55	July 24, '54
Pennsylvania Grade	2,796	2,781	3,219
Other Appalachian	1,823	1,920	1,685
Illinois, Indiana, Michigan	10,872	11,027	12,664
Nebraska, North Dakota	1,863	1,822	(‡)
Kansas	7,920	7,986	9,107
Oklahoma	22,332	22,639	27,282
Arkansas	2,656	3,035	3,541
Louisiana	17,186	16,420	17,646
North	2,621	2,696	2,471
South	14,565	13,724	15,175
Mississippi	3,068	3,105	3,205
New Mexico	8,521	8,218	8,559
Texas	128,601	126,556	130,905
East Texas proper	9,772	9,855	11,871
West Texas	59,418	56,866	56,040
Texas Gulf	25,484	25,691	28,443
Other Texas	33,927	34,144	34,551
Wyoming	14,765	15,216	13,678
Other Rocky Mountain	5,445	5,393	4,746
California	30,809	31,029	32,155
Foreign	†11,370	11,668	11,493
Total	270,027	268,815	279,885

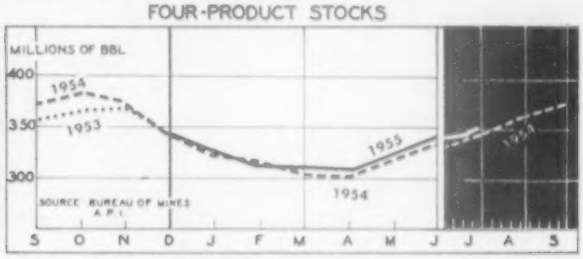
*Bureau of Mines. †Includes 2,814,000 bbl. in California. ‡Included with Kansas.

CURRENT DATA ON RUNS AND PRODUCTION ARE 4-WEEK AVERAGES

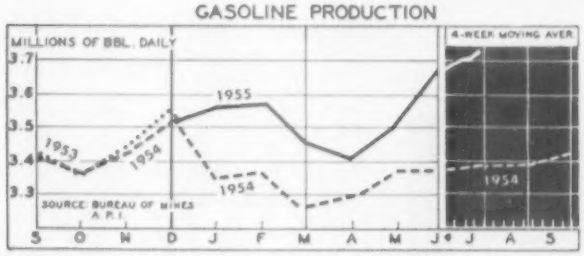
REFINERY RUNS



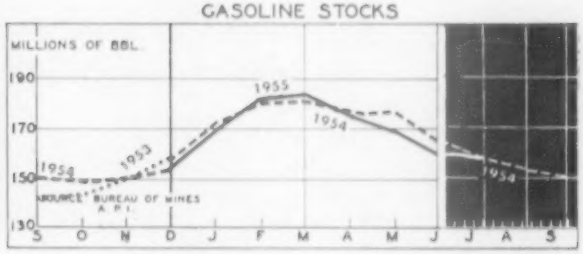
FOUR-PRODUCT STOCKS



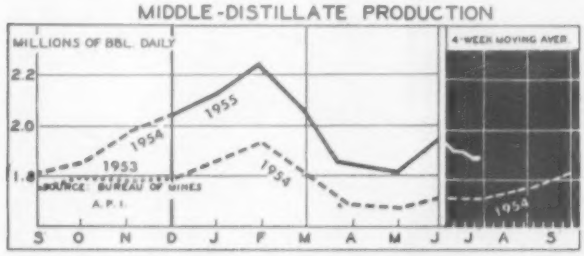
GASOLINE PRODUCTION



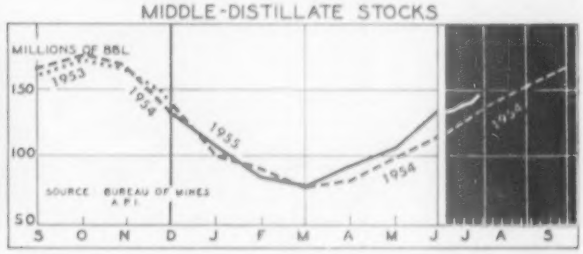
GASOLINE STOCKS



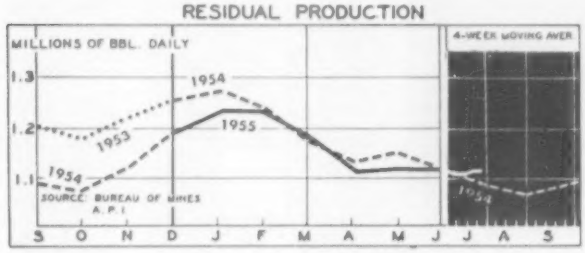
MIDDLE-DISTILLATE PRODUCTION



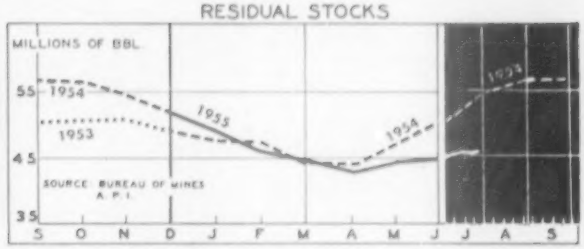
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



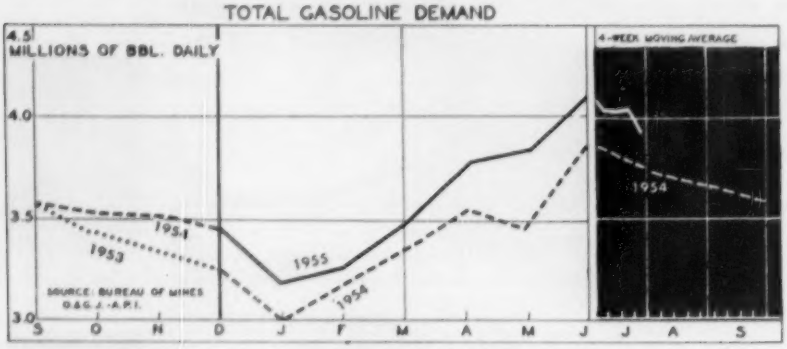
A.P.I. REFINERY REPORT, JULY 29

(Thousands of barrels)

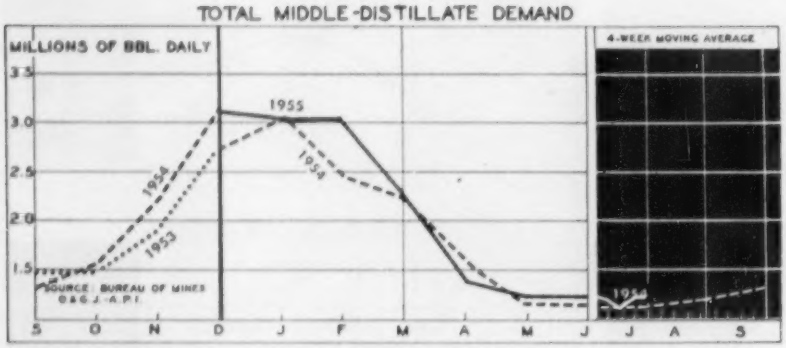
District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, July 1954—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,130	452.4	22.3	291.0	192.3	35,151	12,507	39,205	10,436	1,073	441.0	29.9	241.9	210.9
Appalachian:														
District 1	108	47.6	3.3	26.0	4.1	4,349	559	2,596	341	100	43.9	5.1	20.5	5.5
District 2	99	55.4	2.7	9.9	13.9	2,240	554	950	375	89	48.6	2.2	13.2	10.5
Ind., Ill., Ky.	1,445	781.0	75.7	254.0	172.7	34,176	8,133	22,846	5,135	1,294	696.3	74.0	240.0	157.6
Okla., Kans., Mo.	676	386.0	23.1	155.4	31.7	14,679	2,144	12,959	1,105	600	342.5	14.6	135.2	32.8
Inland Texas	250	179.9	8.7	44.6	22.6	5,971	378	2,151	1,295	232	171.2	9.7	38.0	26.6
Texas Gulf Coast	1,795	880.8	97.3	419.4	247.3	20,684	3,943	14,300	5,378	1,595	790.4	94.5	370.6	213.1
La. Gulf Coast	589	299.8	66.8	124.7	48.2	9,650	2,166	4,922	1,595	565	264.2	54.2	135.2	41.3
N. La. and Ark.	94	34.3	10.9	19.4	4.4	3,904	900	2,013	72	90	34.6	7.5	21.2	6.3
Rocky Mountain:														
New Mexico	20	11.9		3.0	2.7	245	6	91	32	20	11.3	0.3	3.9	2.9
Other Rocky Mtn.	272	125.9	4.0	63.2	33.7	6,227	393	2,636	779	250	116.3	1.4	58.1	30.8
California	1,099	523.1	1.9	162.0	339.3	19,729	317	11,267	18,914	1,008	424.2	1.9	138.1	350.4
July 29, 1955	7,577	3,778.1	316.7	1,572.6	1,112.9	157,005	32,000	115,936	45,457	6,916	3,384.5	295.3	1,415.9	1,088.7
July 22, 1955	7,620	3,709.1	274.4	1,553.0	1,122.4	157,678	31,206	112,392	45,260					
July 30, 1954	6,827	3,332.8	294.4	1,470.6	1,059.9	158,402	31,368	100,439	54,651					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

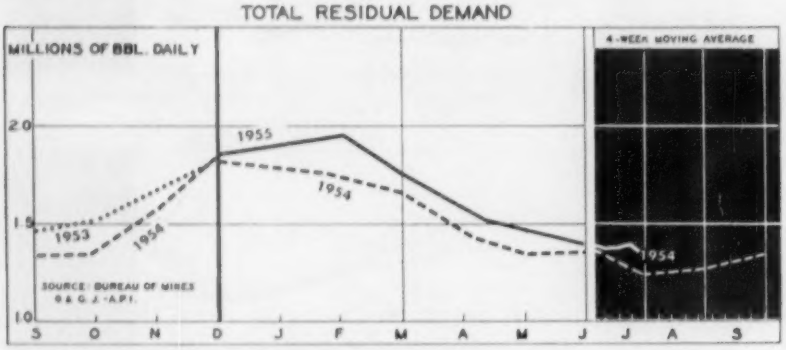
TOTAL GASOLINE DEMAND



TOTAL MIDDLE-DISTILLATE DEMAND



TOTAL RESIDUAL DEMAND



REPRESENTATIVE QUOTATIONS

Spot-market quotations of leading suppliers as of August 3, 1955. Prices are in cents per gallon, except for residual in dollars per barrel and wax in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	11-11.25	11.5-12	10.5-10.75
Premium gasoline	12.25-12.5	13-13.75	12-12.25
42-44 w.w. kerosine	9.25-9.50	10.05	8.5-8.75
No. 2 straw fuel oil	8.25-8.50	9.3	8.5-8.75
No. 6 residual	$1.75-1.85	$2.50-2.70	$2.10-2.25

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.0	4.5	4.75
Grade 18-55	6.0	5.5	5.75

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	18
200 vis., No. 3 neutral, 0-10 pp.	13.25

WAX

Mid-Continent

132-134 A.M.P.	6.0

• The Gulf Coast market presented a strong front over the past week. The price for No. 2 straw fuel moved up to a low of 8½ cents for spot delivery. Advance explained as due to export buying since May with East Coast buyers now seeking August and September cargoes. Other markets generally firm.

PRODUCTION AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

	Refinery prod.	Total demand
Gasoline:		
Four weeks ended 7-29-55	3,736	3,933
May 1955	3,508	3,826
June 1954	3,379	3,894
July 1954	3,384	3,723
Middle distillate:		
Four weeks ended 7-29-55	1,875	1,241
May 1955	1,815	1,237
June 1954	1,705	1,151
July 1954	1,711	1,105
Residual fuel:		
Four weeks ended 7-29-55	1,121	1,366
May 1955	1,111	1,444
June 1954	1,123	1,339
July 1954	1,089	1,226

SUPPLY AND DEMAND*

(Thousands of barrels daily)

	May 1955	April 1955	May 1954
Domestic demand	**7,552**	**7,810**	**6,819**
Gasoline	3,723	3,704	3,368
Kerosine	125	193	157
Distillate	1,023	1,239	932
Residual	1,350	1,456	1,258
Jet fuel	160	140	108
Lubricants	122	120	104
L.P.G.	297	342	263
Other products	713	595	614
Crude loss	39	21	15
Exports	**395**	**357**	**373**
Gasoline	104	82	95
Kerosine	13	9	8
Distillate	76	48	70
Residual	94	97	85
Jet fuel			
Lubricants	37	42	43
L.P.G.	12	11	9
Other products	21	20	23
Crude	38	48	40
Total demand	**7,947**	**8,167**	**7,192**
Gasoline	3,827	3,786	3,463
Kerosine	138	202	165
Distillate	1,099	1,287	1,002
Residual	1,444	1,553	1,343
Jet fuel	160	140	108
Lubricants	159	162	147
L.P.G.	309	353	272
Other products	734	615	637
Crude exp. and loss	77	69	55
Stock change	**539**	**531**	**941**
Crude	55	360	64
Products	484	171	877
New supply	**8,486**	**8,698**	**8,133**
Imports	**1,137**	**1,123**	**1,005**
Crude	743	697	708
Products	394	426	297
Production	**7,349**	**7,575**	**7,128**
Crude	6,677	6,887	6,471
Nat. gasoline, etc.	672	688	657
Runs to stills	**7,268**	**7,136**	**7,038**

*Bureau of Mines.

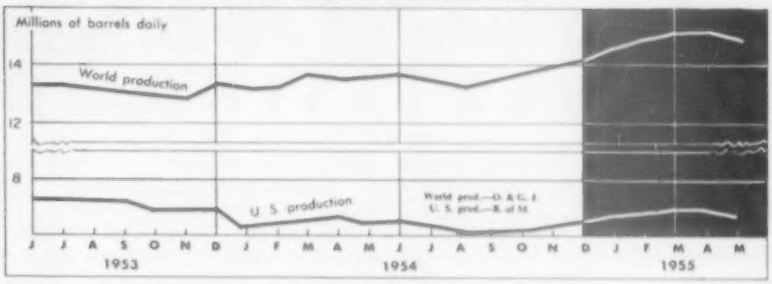
(The schedule of selected crude prices appeared on page 166 of the August 1 issue and will be printed again next week.)

CRUDE PRODUCTION

(Thousands of barrels daily)

Month—	U.S.	World
May 1955	6,677	14,857
April 1955	6,887	15,147
March 1955	6,886	15,116
September 1954	6,151	13,432
May 1954	6,471	13,681

CRUDE OIL PRODUCTION

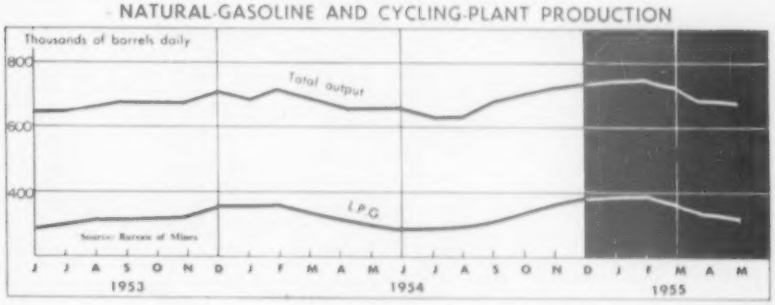


PRODUCTION AT NATURAL-GASOLINE AND CYCLING PLANTS

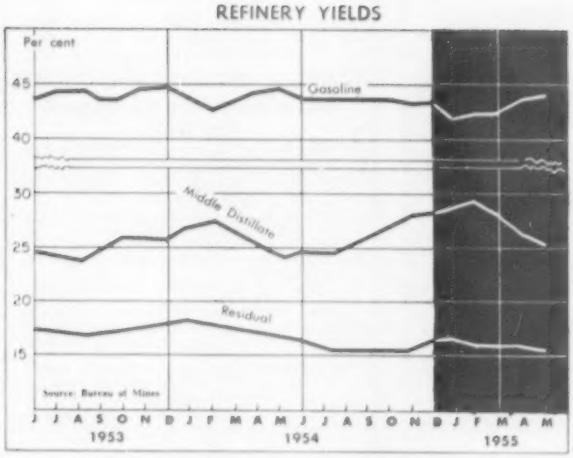
(Thousands of barrels daily)

Month—	L.P.G.	Total
May 1955	317	670
April 1955	334	686
March 1955	361	720
September 1954	315	676
May 1954	304	657

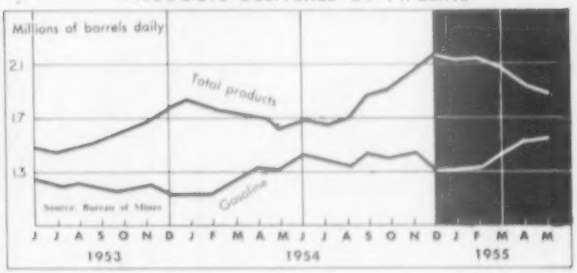
NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



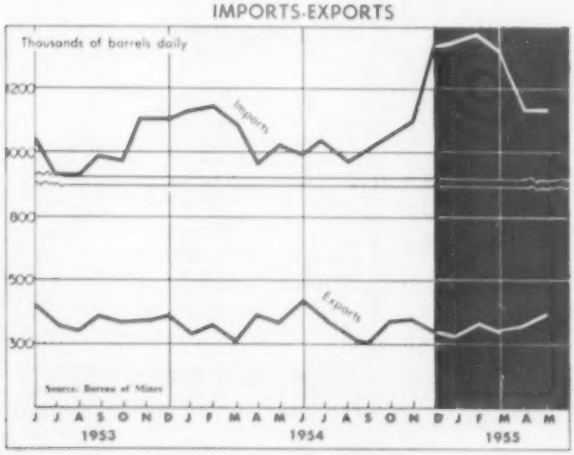
REFINERY YIELDS



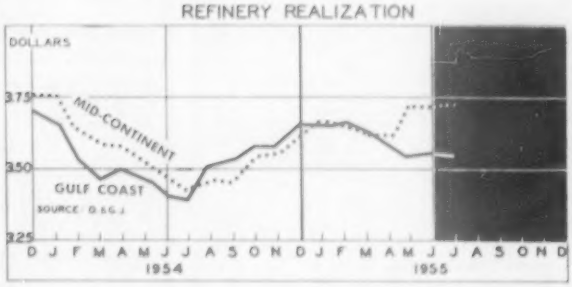
PRODUCTS DELIVERED BY PIPELINE



IMPORTS-EXPORTS



REFINERY REALIZATION



REFINERY REALIZATION

	July* 1955	June* 1955	May 1955	July 1954
Mid-Continent	$3.73	$3.73	$3.72	$3.43
Gulf Coast	3.53	3.54	3.52	3.39

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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Scientific—Accurate—Easy to learn. Mechanical—Magnetic. Equipment weighs from 25 to 50 Lbs. Can be used anywhere. Your insurance against loss. Information—

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Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

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#517—O.C.S. Type 5 Single Drum Unit, with Friction Clutch and Mechanical Controls, Mounted upon 1942 Model LF Mack Truck with 11:00 x 24 tires. No mast or Supports. Good Running Condition FOB Odessa $1,497.44.

#525—Model 50/60 Ideco Unit Powered by BLD 525 Buda Engine, Butane equipped with 250 Gallon Tank. 5 x 7 x 35' Double Pole Mast. Mounted upon 1945 KB6 Tandem International Truck. Complete Unit in fair condition FOB Tulsa $6,000.00.

#531—Cardwell Model KL Double Drum Skid Spudder, Jaw Clutch, Mechanical Controls. Power Model GF-618 Buda Engine, Operates on Butane. 60' Derrick, Three-Sheave Crown, Cable Raised. Unit in workable condition. Engine in pretty fair shape. FOB Seminole $3,875.00.

#536—Franks Model ET-DC Single Drum Well Servicing Unit. Serial No. 301, with 8 x 10 x 62-ft. Single Pole Mast, Tw-Sheave Crown, Cross Sheave, Stinger and Block. Mounted upon International Truck 1941, Model K-8-F, with 450 engine, butane equipped and has two 135-gallon tanks side mounted. FOB Tulsa $7,298.85.

#540—Cooper Model UM Single Drum shop made Winch, Powered by Good VIKU Waukesha with V-Belt Driven Jackshaft. Unit Mounted upon 1950 Model 180 International Single Axle Truck Capable of 4000 foot Well Servicing. No Pole Mast. FOB Tulsa $2,500.00.

#541—Franks ET Serial 222, with 8 x 10 x 62-ft. Single Pole Mast, Divider, Grooved Jacket, Cathead, Mounted on 1948 Model K8 International Truck. Steam Cleaned, painted and adjusted in good serviceable condition. FOB Tulsa $6,210.00.

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FRANKS MFG. CORPORATION
DIVISION OF CABOT SHOPS, INC.
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TULSA, OKLAHOMA

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SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply, Tulsa.

1—OIL WELL GBLU-125 Compressor Unit with 6½ x 13 TB Single Stage Compressor complete with 6 cylinder Waukesha Motor. Unit has an intake of 100# with a discharge of 600#. The above unit was used less than thirty days and can be purchased at a nice reduction. Wire, write or phone Louisiana Iron & Supply Company, Shreveport, Louisiana.

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4—600 HP IR Type KVG Gas Engine Driven 2 Stage Compressors.

$50,000 New Spare Parts for Above.

2—IR Starting Air Compressors, Model 25C, Type 40, 265#, 67.6 cfm.

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1—7'6" x 65'6", 30 trays, 45# psi.
1—7' x 25'6", 10 trays, 347 S/S, 50# psi.
1—6' x 58' x ½" Chrome-lined, 21 Trays.
1—6'6" x 65' x 5/8", 17 Chrome Decks, 9 Chrome Baffles.
1—6' x 27', 14 trays.
1—5' x 27' x 3/8" Shell, 18 Trays.
1—3'6" x 40' x 7/8" Shell, 28 Trays, 180#.
1—30" x 34'10" x ¼" Shell, 18 Trays.

TANKS - VESSELS

6—1250, 1,000 Bbl. Welded and Bolted, 10—8' x 15', 10' x 20', 6' x 20', 5'3" x 38'6", (Ch. Lin. 90#); 3'10" x 38', (325# 950° F), 7' x 15', 8' x 18'.

HEAT EXCHANGERS

3—Kellogg 2400 sq. ft. Admiralty, 150# psi.
1—Efco Steel Tube 1500 sq. ft., 150# psi.
1—Griscom Russell Admiralty, 742 sq. ft., 150# psi.
3—Struthers-Wells Admiralty, 425 sq. ft., 150# psi.

ATMOSPHERIC HEAT EXCHANGERS

8—715 sq. ft., 850 psig, 550° F., S/S.
6—470 sq. ft., 850 psig, 550° F., S/S.
13—715 sq. ft. 125 psig, 300° F., S/S.
6—715 sq. ft. Admiralty 125 psig, 300° F.

MISCELLANEOUS

1—Lab Petrochem Isoflow Furnace 50,000 BTU/hr.
1—B.J. Hot Oil Pump 3" x 9", 14 stage, 325 gpm, 4620' head, 11-13 nickel chrome impeller, 400 HP st. turbine.
1—Gould 4" Pump 300 HP, 3550 rpm, 400 gpm at 600' hd.

Partial List Only

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BRILL EQUIPMENT COMPANY

4101 San Jacinto St., Houston 4, Texas, JA 6-1351
Or
2401 Third Ave., New York 51, N. Y., CYpress 2-5703

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TRAILER completely equipped, gas detectors, laboratory, bedroom, ideal for mud logging company, geologists, drilling contractors. Also new 2-way radio system. Trailer $1700. Radio system $1000. Call 18, Baird, Tex. Other completely equipped trailers available.

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Large Stock—Styles 190P and 200P
Drawings Available on Request.
PRICE: $200.00 each.

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Gasoline Plant Equipment For Sale

3—800# 20 MMCF Absorbers with Scrubbers, etc.
2—150 HP 350# WP Lucey Oil Country Boilers Complete with Stacks, etc., and Steel Building.
1—30"x62' Depropanizer with Accumulator, Reboiler and Condenser.
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Other Equipment, Instruments, Pumps, Pipe, Valves and Fittings necessary in Gasoline Plant Construction. Detailed Inventory Available upon request.

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NEW PRIME DOMESTIC STEEL

4 x 3½ x 5/16—Angles
4 x 3½ x ¼—Angles
10" CHANNEL—15.3 lbs.
5 x 5 x 3/8—Angles
5 x 5 x ½—Angles
6 x 4 x 3/8—Angles
25 Tons Each Item
60-65 ft. lengths
Immediate shipment
Subject to Prior Sale

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4'x59' 23 trays, 160 PSI.
7'6"x41'7" Reactor, 160 PSI.
4'6"x40' 13 trays, 180 PSI.
2'x47' 20 trays, 200 PSI.
2'x47' 20 trays, 375 PSI.
3'x49' 28 trays, 425 PSI.
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5'x36' Scrubber, 240 PSI.

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Crude Oil, 8 million BTU/hour comb. oil & gas burners, chrome tubes (2).
Cracker, light oil, 10 million BTU/hour comb. oil & gas burners, chrome tubes.
Vacuum, 15 million BTU/hour comb. oil & gas burners, chrome tubes.

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Steel Tubes, 94 to 550 sq. ft. (5)
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170 to 300 CFM Elec. & Steam.
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(11) from 150 sq. ft. to 2500 sq. ft.

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3—153 HP 160 PSI Water Tube.
1—250 HP 150 PSI Stirling.

ETHYL BLENDING PLANT

Complete Unit.

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Quantity—All Types.

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½" to 12" Welded and Seamless.

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Hot Oil Pump 5x12 Worth. Diesel drive.
Tower 3'x44', 18 trays, 300 PSI.
Building 130'x360' Bow String Truss.

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3—Busch-Sulzer 3060 HP, 240 RPM Diesel Engines, direct coupled to 3—2700 KVA E.M.C. Alternators, 3/60/2300/4160, with all accessories.

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WHEATLEY-TRIPLEX PUMP, FW-3108 5¾" x 8" stroke. Powered with 6DH-1879 Buda Diesel Engine—excellent condition. Degen Pipe & Supply, Tulsa.

SUBJECT PRIOR SALE boilers all sizes. f.b.-h.r.t. and water tube 50-1000 hp. Special offer 150 hp. 350 lbs.—f.b. units almost new on 12" I.B. skids including all accessories and 2" metal clad insulation. Box H-960, The Oil and Gas Journal, Tulsa, Oklahoma.

BUCYRUS-ERIE spudder, 24-L, trailer mounted, casing tackle strut, Kohler light plant, 2000' ¾" line and 2000' ¾" line, other accessory equipment. Ph. 4603 Murdocksville, Pa. or write Box H-959, The Oil and Gas Journal, Tulsa, Oklahoma.

MUST SACRIFICE one rotary rig, consisting of: Union Drawworks, with all air operated friction clutches. Three 145 h.p. Cummins Diesel engines, compounded. One 7¼"x14" Wheeling mud pump. One A-frame, doubles, reinforced mast and superstructure. One 17½" Oil Well turntable. One doghouse. One fuel tank. One water tank. One light plant. One water pump. Catwalk, pipe racks, and steps. Five drill collars. Contact M. Worthington, Box 606, Holdenville, Oklahoma, or phone 723.

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New Worthington Packaged Gas Compressor Units complete and skid mounted. Horse Power Range 50 to 300. Discharge Pressures to 1500 P.S.I.G. Buda or Waukesha Power Units.

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900 HP ALCO ENGINES

Mod. 8-12-½- x 13, 700 RPM Supercharged, Hydr. Coupling #3497-8, 3500, Very Low Price.

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Adaptable to Perforating or Swabbing Units

1950 GMC 1½ Ton Truck. Body Streamlined to cab. Reel can contain 18M Ft. 5/16" Amergraph Cable. Also measuring wheel.

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Phone LUther 4-6731

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FOR SALE: ENGINE—165 Hp. Climax Model R61, maximum continuous Hp. rating 128. Herndon Drilling Company, 421 Mayo Building, Tulsa. Phone GIbson 7-9708.

3—STERLING VIKING Marine Type, 8 Cylinder Engines complete with accessories, 300 H.P. @ 900 R.P.M. Two of these engines converted for stationary duty and equipped with Pickering Governors, Cycoil Air Cleaners, Natural Gas Carburetors, and Wahlbert-McCreary Air or Gas Starters. Price $3,700.00 each. One Engine suitable for conversion for stationary duty. Price $1,600.00. All engines in first class condition, factory run-in time only. Anchor Gasoline Corporation, 714 Atlas Life Building, Tulsa, Oklahoma. Phone LUther 4-5291.

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FOR SALE—Variable Speed Wound Rotor, 300 H.P. Elliott Motor Design 12-S-01 No. 1817—2300 Volt—Amp. 67.5 Frame 2510—3540 R.P.M. 60 Cycle 40° C. Rise—SEC Amp. 168 SEC Voltage 765 complete with controls, running condition—available Honey Brook, Pa. Sun Pipe Line Co., 1608 Walnut St., Philadelphia 3, Pa.

2—300 BBL. and 1—400 bbl. steel welded stock tanks, with stairs and walkway, 1—BS and B heater, 1—skid circulating Unit, all in excellent condition. LUther 4-4545, Tulsa, Okla., Box 1581.

FOR SALE: Franks Giant Clipper, Self propelled servicing unit, 1954 model powered with GM 6-110, equipped with B-J hydraulic tongs. G-300 Emsco (7½ x 14) Mud pump unitized with GM 62 107 torque converter, chain drive power unit. New Jan. 1955. Unitized rotary table GM 4-71 torque drive to 13¾" Franks table. New Nov. 1954. 8 x 12 x 12 substructure in unit with 35' pipe rack trailer. 8500 ft. 3½" O.D. N80 drill tubing, external upset Pitts. 6 thread couplings. Drill collars, subs and tongs. New 1954. G. & S. Sales, 1200 N. Fair Oaks Avenue, Pasadena, California.

FOR SALE: 1—Beaird—Ingersoll-Rand packaged Compressor Plant, Type 6-JVG (165 H.P.) Heavy-Duty, direct connected, 4-cycle, gas engine driven, single stage equipped with 3—4¼ x 9 compressor cylinders, three hand operated fixed volume pockets, two hand operated valve lifters, 20" O.D. 500# W.P. intake scrubber, air starting equipment and controls for automatic operation. Designed for intake pressure range 100#-250#, discharge pressure range 500#-600#. Delivery 3,480 MCF per day at 250# intake, 550# discharge. This plant has been in use less than 30 days and is located near Palestine, Texas. Box H-616, The Oil and Gas Journal, Tulsa, Oklahoma.

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1 Used Cardwell Model "S" Rig with Two WAK Engines and compound; 87' Lee C. Moore Jackknife Derrick with Substructure, Crown and Traveling Blocks, Hook and Rotary. Located at Liberty, Texas.

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8" Pipe—For Surface Casing

50,000 ft.—8⅝" O.D., 28.55# Used Lapweld Line Pipe. Machine Cleaned, Straight, 20' SRL with 8" 8-V thd. Line Pipe Coupling one end, other end beveled ready for threading. Suitable for shopping into Surface Casing or Water Well Casing.

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Humboldt-Chicago Pipe Line Project

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CHerry 2-9128 — Phone — LUther 3-5400

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LINER FOR 5½, 1000' 4" o.d. seamless. 8rd thread. 85c and 8000' 2¼" o.d. seamless. New. Plain end. 20' lengths 18c. 40' 20c. Ideal for any purpose. M. J. Regan Pipe Co., Coffeyville, Kans.

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FOR SALE—At Oil Hill, Kansas one 3½" x 7" Aldrich Vertical Triplex Pump, Serial No. 15579. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

PORTABLE WORKOVER RIG—Cardwell KL drawworks with Telescoping mast, all tools. Pickup truck and House trailer. Price $8000.00. Spartan Well Service, 1201 Wilson Bldg. Corpus Christi, Texas.

FOR SALE—at our Russell, Kansas warehouse. Three 40 HP OCS single crank BAT Pumping Units recently reclaimed from pumping wells. Price $1750.00 each. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

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A SPUDDER capable of drilling 3,500 ft. Give details in first letter. The Chatham Oil Co. P. O. Box 204, Rangely, Colorado.

WANTED—Complete rotary rig, late model, 4,000' drilling. Prefer Moore trailer derrick with U-34, T-20 or equivalent. Cash. Keith Morton, Valier, Montana.

WISH TO PURCHASE one 400 ton casing pulling unit complete with necessary accessories to pull 5½" through 15¼". Furnish inventory, location, and price. Box H-963, The Oil and Gas Journal, Tulsa, Oklahoma.

CARDWELL MODEL H double drum truck mounted machine in good condition, equipped for rotary workover. Send inventory and full details to Box H-949, The Oil and Gas Journal, Tulsa, Oklahoma.

WE BUY—for salvage abandoned wells, leases and pipe lines; Texas and Louisiana. PIPE Inc., Box 1965, phone TUlip 4-4029, Corpus Christi, Texas.

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ROTARY RIG complete ready to work, 3000 foot capacity. Please state price, location, make of components, condition and include inventory in first letter. Tools must be in A-1. Box H-939, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Quantities of 10¾" 8-V or 8 round thread #1 Grade Used Casing or Line Pipe Couplings and quantities of 7" 10-V thread #1 Grade Used Casing Couplings, also interested in buying used casing and tubing. THE BUCKEYE SUPPLY COMPANY, 18 Harrison Street, Zanesville, Ohio.

WANTED—One 200 hp. LeRoi Gas Engine, type H2000. W. Caplis, Box 1312, Shreveport, Louisiana.

GAS DRIVEN compressor, non-lubricated type. Capacity 6,000,000 to 10,000,000 SCFD, suction 500 PSIG, deliver at 650 PSIG. Also a Scotch Marine Boiler, 150 HP, 150# working pressure. Advise cost, location, condition and other details. Box 426, Irving, Texas.

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GRADUATE Chemical Engineers with at least two years experience for positions open in Refinery operations located in Tulsa. State qualifications and salary expected. Write Personnel Department, P. O. Box 381, Tulsa, Oklahoma.

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For work on DeMares Concession in Colombia. Knowledge of Drilling and Mud Problems Essential. Only Graduate Engineers Considered.

BOX H-957,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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PROCESS DESIGN
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Must have degree in chemical engineering; minimum of five years experience in petroleum refinery design; capable of evaluating refinery operations and data, preparation of process calculations, process flow diagram and equipment specifications. Follow through on mechanical design of facilities. Will be expected to make independent analyses and exercise individual judgment. Please write to Chief Design Engineer and give full details of personal history and work experience. Provide references and include photograph.

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3700 West 190th Street
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CHEMICAL ENGINEERS
(Supervisory)

For responsible staff positions in New York Office directing the work of groups of experienced engineers doing process evaluation and design, economic studies and related work on refining and crude oil handling facilities, together with supporting power plants and other utilities. Chemical Engineering degree plus 10 years' process experience, preferably in petroleum, is desired.

Salary commensurate with training and work experience. Write giving full particulars regarding personal history and work experience. Please include telephone number.

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GEOLOGIST of outstanding ability for strong independent oil company establishing district headquarters in New Orleans, La., for operations in Coastal Louisiana. Must have had at least seven years diversified subsurface experience in Louisiana and Upper Texas Gulf Coast and be able to evaluate a subsurface or seismograph prospect. Bacher degree minimum requirement. This is a position that requires initiative and enthusiasm for oil finding. Permanence of employment and opportunity for advancement are assured if expanded operation is successful. Attractive salary. Applicant should give complete background information, references, and salary expected. Replies strictly confidential. P. O. Box 432, Corpus Christi, Texas.

ELECTRICAL ENGINEERS
MECHANICAL ENGINEERS
CIVIL ENGINEERS

Pipe line company has openings for Electrical, Mechanical, and Civil Engineers for employment in Engineering Department and District Headquarters. If you are a Graduate Engineer and interested in permanent employment with good opportunity for advancement in the pipeline industry address letter of application, including a recent snapshot.

Box H-956,
The Oil and Gas Journal,
Tulsa, Oklahoma

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RESEARCH

A decision to expand markedly drilling and production research activities at THE RESEARCH CENTER OF THE GULF OIL CORPORATION creates excellent opportunities for

B.S. THROUGH PH.D GRADUATES IN:
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Major oil company has opening in production research for a man with petroleum engineering and/or geological background. Work involves research on core-analysis methods, fluid-flow, and related petroleum reservoir studies. Location, midwest. Applicant should supply complete resume of education, experience, qualifications, references and salary expected. All replies confidential.

Box H-926,
The Oil and Gas Journal,
Tulsa, Oklahoma

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At Our
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with an engineering firm
having over 50 years of
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The McKEE Organization
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McKEE designs and constructs Blast Furnaces, Open Hearth Furnaces, Sintering Plants and Auxiliary Facilities; Oil Refineries, Chemical and Petro-Chemical Plants. All of these afford a wide diversification of opportunities to energetic and qualified Engineers.

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WANTED: By an independent oil company, a graduate Petroleum Engineer with varied experience in secondary recovery operations in the Tri-State area. Please give full particulars of experience and salary expected in the first reply. Box H-946, The Oil and Gas Journal, Tulsa, Oklahoma.

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FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

EXCELLENT OPPORTUNITY with independent oil company for GRADUATE PETROLEUM ENGINEER, under 35, at Midland, Texas. Must have three years' West Texas experience and be outstanding in field production problems, workovers, testing, drill stems and completions. Replies confidential. P. O. Box 3053, Dallas, Texas.

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28, MARRIED, M.S., yr. teaching exp., varied subsurface exp. W. Tex. Desire locate Denver. Box H-962, The Oil and Gas Journal, Tulsa, Oklahoma.

OKLAHOMA UNIVERSITY Geological Engineer, 8 years experience on geophysical crew, 3 years Party Chief. Desire Position as geologist-seismologist combining permanency and interesting work. Box 1363, Midland, Texas.

DIVISION ENGINEER, excellent geological training. Desires association with aggressive independent. Salary open. Box H-964, The Oil and Gas Journal, Tulsa, Oklahoma.

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RESERVOIR ENGINEER—M.S. Degree and 4 years experience with major company in Secondary Recovery and Primary Development Programs desires position with advancement. Box H-941, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED Petroleum Executive—College chemistry graduate, age 40, integrated independent background. Well qualified with extensive top-level refinery management, sales, transportation, and production experience. Earnings in excess of $18M annually. Want permanent position with growth opportunity. Box H-933, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-ENGINEER, thoroughly experienced in office and field procedure by 8 years of major and 8 years independent work in South Texas, Gulf Coast, Louisiana, Oklahoma, East & West Texas. Desire connection with active independent or individual. Box H-934, The Oil and Gas Journal, Tulsa, Oklahoma.

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WANTED—Production and acreage to drill in Butler County, Kansas. Box H-950, The Oil and Gas Journal, Tulsa, Oklahoma.

ANYONE interested in financing the drilling of shallow wildcat well with proven gas with oil show? Have 4800 acre block several prospective sands. All less than 2800 ft. formation shale & chalk. Contact Mathews & Keys, Attorneys, Arkadelphia, Ark.

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PARTNER WANTED: I wish to form an association with some reliable individual Oil Operator or Drilling Contractor, who already has or can get good drilling prospects. I am in position to raise capital for promotional drilling. Exchange of references essential. Box H-945, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE OWNER of acreage over Gas and Oil seepages needs financing to drill shallow wells in Anderson County, Tennessee. Excellent structures. Gas markets nearby. Contact E. A. Munyan, 102 Fairview Drive, Fairfax, Va.

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OFFERING CHOICE PRODUCING oil income royalties with large reserves per Dollar investments. A. S. Berry, P. O. Box 1383, Tulsa, Okla.

FOR SALE: Oil Royalty under Sections 15, 26, 25, all in Twp. 1 N—Range 58 West, Morgan County, Colo. Four wells producing at present time. Write H. L. De Laney, South Star Route, Fort Morgan, Colo.

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JACK EAGLE, Oil Properties, 706 City Nat'l. Bldg., Oklahoma City, Oklahoma, Telephone REgent 6-7027.

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SCOUTING SERVICE

APPALACHIAN BASIN—Weekly scout reports, exploration and development: New York, Penna., & W. Va. For information write: H. & R. Scouting Service, Box 312, Coudersport, Pa.

Equipment Men

Neptune Meter Names McKenzie to Sales Staff

Harry J. McKenzie, Kansas City, Mo., has been named a sales representative for petroleum and industrial meters manufactured by Neptune Meter Co., Ira T. Collar, Jr., branch manager in North Kansas City, has announced.

McKenzie will be assigned to the territory covering Iowa, Missouri, and Kansas.

Before joining Neptune, McKenzie was a sales representative for Cities Service Oil Co. in Nashua, Iowa.

Failing's Houston Branch Gets Additional Franchise

The Houston branch store of the George E. Failing Co. of Enid, Okla., a subsidiary of Westinghouse Air Brake Co. of Pittsburgh, has been awarded the distributor franchise for the Houston area for all products manufactured by the industrial products division of Westinghouse Air Brake Co., of Wilmerding, Pa., according to an announcement by J. T. Tucker, general manager of sales for the Failing company.

All articles manufactured by the industrial products division of Westinghouse Air Brake Co. will be stocked and serviced by the Failing branch in Houston. Repair facilities will be available, including pneumatic-control devices for rotary-drilling rigs and marine vessels. Specifically they are: control and line valves, power-conversion devices, air-compressors and pressure tanks for drilling rigs; pneumatic-control systems for diesel engines used on tugs, dredges, fireboats, workboats, and towboats; power steering for off-the-highway vehicles; and desurgers for refineries, chemical plants, and other systems requiring surge-control equipment for flowing liquids.

Dick Miles is the branch manager.

ADVERTISERS IN THIS ISSUE

Aero Design and Engineering Company 35
Allis-Chalmers Mfg. Co. 114
American Blower Corp. 38
American Iron & Machine Works Co. Back Cover
Aquaness Corporation 149
Armco Drainage & Metal Products, Inc. 118
Baker Oil Tools, Inc. 110
Barrett Division Allied Chemical & Dye Corporation 36
Beaird Company, Inc., The J. B. 13, 14
Bendix Aviation Corporation 18
Bethlehem Supply Co. 12
Black, Sivalls & Bryson, Inc. 49
Bos-co Equip't Eng'r'g & Mfg. 140
Brown & Root, Inc. 103
Byron Jackson Co. 105
Chemical Process Co. 167
Chicago Bridge & Iron Company 97
Chiksan Company 128
Chrysler Corporation—Industrial Engine Division 150
Classified Advertising 181, 182, 183, 184
Coates Field Service, Inc. 141
Columbus Hotel, The 130
Crosby Products Division, American Hoist and Derrick Co. 141
Crose Manufacturing Co., Inc., M. J. 122
Darling Valve and Mfg. Co. 47
Davison Chemical Company Division of W. R. Grace & Co. 10
Dean Brothers Pumps, Inc. 122
De Laval Steam Turbine Co. 9
Dewey Supply Company 116
Dowell Incorporated 60, 135
Drilling & Service, Inc. 168
Drilling Specialties Co. 154
Dunham Tanks Division of Anderson-Dunham, Inc. 25
du Pont 5
Edward Valves, Inc. 131
Electrochemical Laboratories 171
Evinrude Motors Division of Outboard, Marine & Mfg. Co. 152
Fabri-Valve Company of America 130
Fairbanks, Morse & Co. 4
First National Bank & Trust Co. of Tulsa, The 141
Fluor Corporation, Ltd., The 126
Fuller Company 33
Garlock Packing Company, The 52
Gaso Pump & Burner Mfg. Co. 45
General American Transportation Corporation 109
Globe Oil Tools Company 113
Grancell, I. H. 131
Guiberson Corporation 17
Halliburton Oil Well Cementing Co. 15, 158
Houston Oil Field Material Company, Inc. 8
Huey & Co., S. E. 140
Hughes Tool Co. 99, 100
Inferno Co., The 164
Jenkins Brothers 31
Johnston Testers, Inc. 139
Jones & Laughlin Steel Corporation Supply Division 19
Jones Company, The S. M. 162
Kemp Mfg. Co., C. M. 28
Kidde & Company, Inc., Walter 30
Kinzbach Tool Co., Inc. 122
Layne & Bowler, Inc. 124
Leland Electric Co., Division of American Machine & Foundry Co. 42
Le Roi Division of Westinghouse Air Brake Co. 26, 27
Linde Air Products Company, A Division of Union Carbide and Carbon Corp. 11
Lufkin Foundry & Machine Co. 147
Magnet Cove Barium Corp. 117
Manton-Gaulin Manufacturing Company, Inc. 48
Mark & Company, Clayton 140
Mission Mfg. Company Inside Back Cover
National Bank of Commerce, The 39
Newalls Insulation Co., Ltd. 136
Nordstrom Valve Division, Rockwell Manufacturing Company 23, 24
Oil Well Supply Division 6
Orbit Valve Company 37
Otis Pressure Control, Inc. 133
Pacific Coast Borax Co. 53
Palmer Filter Equipment Co. 130
Paris Distributor, Inc., Henry H. 54
Parkersburg Rig & Reel Co. 46
Peerless Supply Co. Inc. 171
Petroleum Distributing Co. 152
Petroleum Electric Power Assn. 20
Philadelphia Gear Works, Inc. 186
Procon Incorporated 43
Republic Rubber Division of Lee Rubber & Tire Corp. 21
Republic Steel Corporation 50, 51
Robbins & Myers, Inc. 148
Schlumberger Well Surveying Corp. 169, 170
Scintilla Division of Bendix Aviation Corp. 18
Scott-Rice Company 171
Second National Bank of Houston 29
Smith Corporation, A. O. Hydraulic Division 22
Southwest Industries, Inc. 132
Spang & Co. 163
Stewart & Stevenson Services, Inc. 32
Templeton, Kenly & Co. 165
Thomas Flexible Coupling Co. 153
Thornhill-Craver Co. 120
Toledo Pipe Threading Machine Co. 55
Union Asbestos & Rubber Company 16
Union Carbide and Carbon Corporation 11
Union Tank and Supply Company 55
United States Steel Corporation—Oil Well Supply Division 6
United Supply & Manufacturing Co. 142
Vickers Incorporated 34
Victor Products Corp. 171
Vogt Machine Co., Henry 44
Walworth Co. 7
Warren Petroleum Corporation 58
Welex Jet Services Inc. 40
Well Equipment Mfg. Corp. 166
Westinghouse Air Brake Co. 56
Wickwire Spencer Steel Division, Colorado Fuel and Iron Corp. 41
Williamson, Inc., T. D. 139
Willys Motors, Inc. 164, 165
Wyatt Metal & Boiler Works Inside Front Cover

LEGAL

SEALED BIDS FOR SALE OF OIL AND GAS ROYALTY INTERESTS on the Crow Indian Reservation, Montana, will be received in the Office of the Superintendent, Crow Agency, Montana, until 2:00 O'Clock (M.S.T.), WEDNESDAY AUGUST 10, 1955 at which time they will be opened and publicly read. Six (6) Units consisting of 80 and 120-acre tracts now under Oil and Gas Leases are involved. Sale of a "one-half (½) of a one-eighth (⅛)" interest in the Royalties in each case by individual allottees owning such mineral interest is being made. For further detailed information and a list of the lands and interests advertised call or write: L. C. Lippert, Supt., Crow Indian Agency, Crow Agency, Montana.

LEGAL

SEALED BIDS will be received until 10:00 A.M. Tuesday, August 23, 1955, and opened at that time at the Cheyenne & Arapaho Sub Agency for the leasing of allotted and tribal Indian lands located in Custer and Washita Counties, Oklahoma, for oil and gas mining purposes. For additional information write or telephone Mr. Edzards, Area Field Representative, Cheyenne & Arapaho Sub Agency, Concho, Oklahoma, through El Reno, telephone 2238-W-1.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that approximately 391.13 acres of land in three parcels, within the known geologic structure of Wellington Field, in Larimer County, Colorado, and 316.80 acres, in one parcel, within the known geologic structure of the Lee Field, undefined, in Morgan County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p. m., M.S.T., August 25, 1955, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. George H. Woodhall, Manager.

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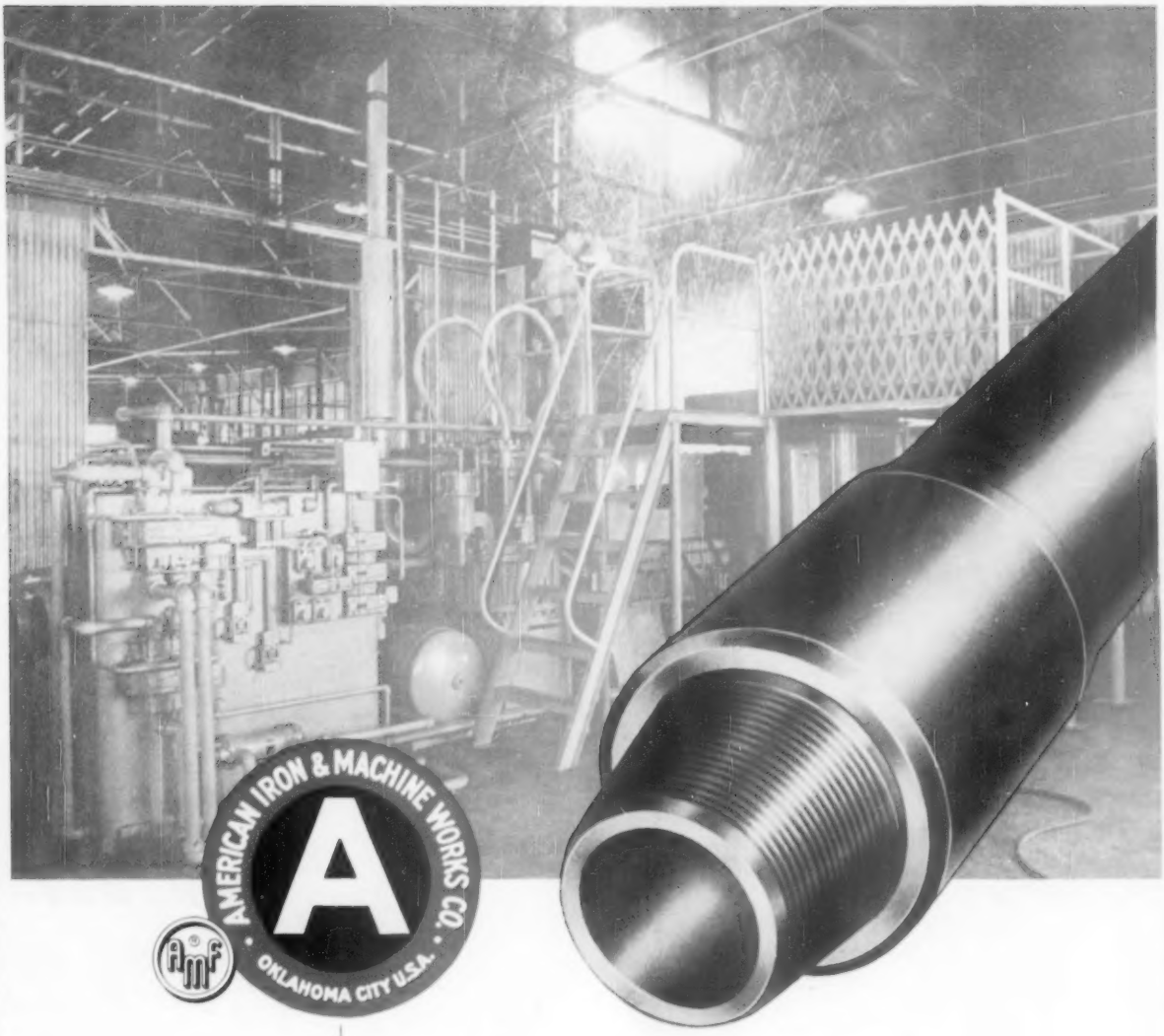

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